

2004

Swift Creek Reservoir & Watershed Hydrologic and Water Quality Data



Addison-Evans Water Production & Laboratory Facility
Department of Utilities
&
Department of Environmental Engineering
Chesterfield, Virginia
&
KCI Technologies, Inc.

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BY

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Facility

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October, 2005

2004 Reservoir and Watershed Report

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Chapter 1: Introduction

INTRODUCTION

This report presents the water quality data collected by the Addison-Evans Laboratory Staff for the period of January through December 2004 and represents the thirteenth consecutive year of monitoring of Swift Creek Reservoir and its watershed. The objective of this report is to present past and present water quality conditions. Specifically, this report:

- 1) provides general water quality and biological data,
- 2) quantifies the phosphorus load, and
- 3) determines the water budget for Swift Creek Reservoir.

During 2004, pool elevations measured at the dam ranged from 177.1 to 179.0 feet above mean sea level, corresponding to approximate reservoir volumes of 4.55 and 6.5 billion gallons respectively. As in prior years, the reservoir exhibited thermal and dissolved oxygen stratification at its deeper areas beginning in April and lasting through September. Water quality samples were obtained at the established eight sites throughout the reservoir (Figure 1-1). Analyses performed are described in Tables 1-2 and 1-3.

Details regarding specific physical characteristics of the watershed and other attributes such as soil types are outlined in previous reports (Hoehn *et al.*, 1998; SCWTP, 1999). Although residential development is common adjacent to the reservoir in its drainage area, the most recent land use data (Table 1-1, from CH2M Hill, May 2000) found that 71.2% of the watershed was of undeveloped forests and pastures.

Monthly baseflow and periodic stormflow water quality samples were collected at nine tributary stations and at the two permanent direct runoff sites within the watershed (Figure 1-1). Sites and identification numbers remained the same as in previous years, as outlined below:

Site 1 = Dry Creek	Site 4 = Otterdale Branch	Site 8 = Ashbrook Dam
Site 2 = Westbranch	Site 5 = Swift Creek	Site 13=Chimney House (Brandermill)
Site 3-I = Horsepen Creek	Site 6 = Tomahawk Creek	Site 14 = Chestnut Bluff (Woodlake)
Site 3-II = Blackman Creek	Site 7 = Little Tomahawk Creek	

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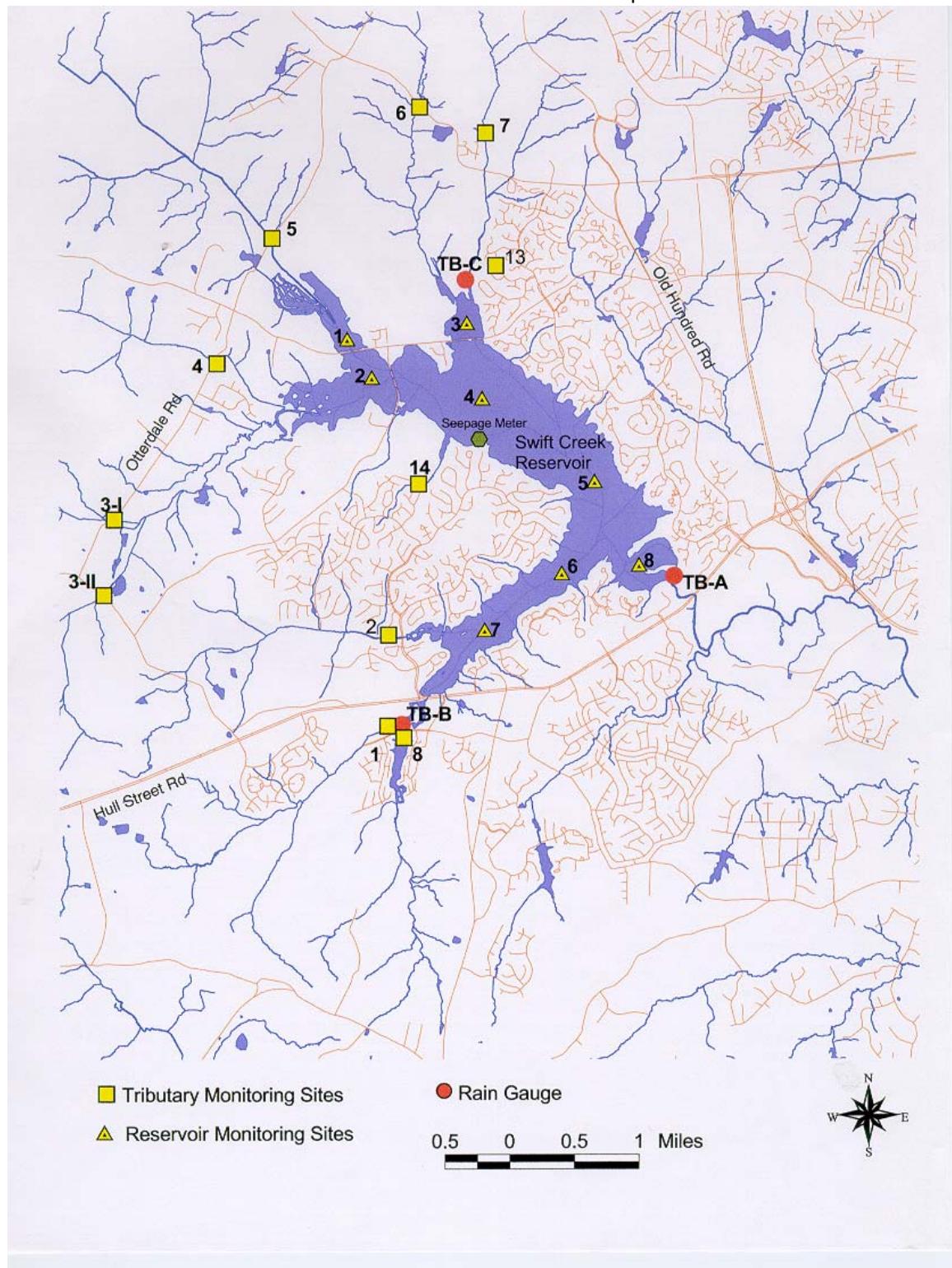


Figure 1-1. Map of Swift Creek Reservoir and Immediate Vicinity

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Table 1-1
Land Use Characteristics of the Swift Creek Watershed
(from CH2M Hill, 2000)

<u>Land Use Type</u>	<u>Area (acres)</u>	<u>Area (sq. miles)</u>	<u>Percent of Watershed</u>
Single Family Residential - Rural	5095	7.96	12.85
Single Family Residential - Semi-Rural	1001	1.56	2.53
Single Family Residential - Suburban Low Density	845	1.32	2.13
Single Family Residential - Suburban Medium Density	888	1.39	2.24
Single Family Residential - Suburban High Density	494	0.77	1.25
Multi-Family Residential	73	0.11	0.18
Community Mixed Use	567	0.89	1.43
Regional Mixed Use	31	0.05	0.08
Major Thoroughfares	1107	1.73	2.79
Industrial	29	0.05	0.07
Cropland	1085	1.70	2.74
Pastureland	905	1.41	2.28
Forest	26,831	41.92	67.68
Grass	510	0.80	1.29
Water	181	0.28	0.46
Conservation, Passive Recreation	0	0.00	0.00
Total	39,642	61.94	100.00

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Reservoir sampling occurred once a month throughout the year at all 8 stations with additional samples obtained every other week at the lacustrine zone sites (5 and 8). At these deeper water sites, discrete epilimnion, metalimnion, and hypolimnion samples were taken for nutrient analysis. The shallower sites in the reservoir, stations 1, 2, 3, 4, 6 and 7, were sampled at the surface only.

Water quality parameters (Table 1-2) were chosen to provide information on basic water quality, the ecological health of the reservoir and its tributaries. Analysis procedures are listed in Table 1-3. Greater detail on sampling and analytical methods can be found in the 1997 report of reservoir water quality (SCWTP 1999).

Rainfall was measured at three automated rain gages within the watershed. The average rainfall over the watershed totaled 55.23 inches during 2004 (Figure 1-2). High rainfall leads to more runoff in the watershed and consequently higher phosphorus loading and shorter hydraulic residence times in a given year.

Quality Assurance and Quality Control:

All analytical methods used were EPA approved, in accordance with *Standard Methods for the Examination of Water and Wastewater* (Standard Methods) with the exception of free ammonia analyses which were made following the Hach Chemical Company's test kit procedure (Table 1-3).

For each parameter analyzed, Method Detection Limits (MDL) were calculated following the EPA procedure as detailed in the *Code of Federal Regulations (CFR), Volume 46, Part 136 Appendix B* (EPA, 1984). Stock and standard solutions were prepared from American Chemical Society reagent grade materials for preparation of calibration standards. Correlation coefficients were evaluated for each calibration curve and had to be greater than or equal to 0.995 to be used for analysis. To ensure calibration validity throughout an analysis, Continuing Calibration Verifications (CCV) standards were tested after every 10 samples analyzed. Similarly, Continuing Calibration Blanks (CCB) were evaluated after every 10 samples to detect any baseline drift errors. With each analysis, field blanks and digestion/analytical blanks were evaluated to ensure detection of contamination during sampling or sample preparation. Independent source Standard Reference Materials (SRM) were purchased and used to verify the accuracy of each analysis calibration. When any standard (or SRM) was not within 10 percent (per EPA guidelines) of the true value, or CCB showed baseline drift, corrective actions were implemented and samples reanalyzed.

Table 1-2. Sampling Regime For Swift Creek Reservoir And Its Watershed (2004)

<u>PARAMETERS</u>	<u>STORM</u>	<u>TRIBUTARY</u>	<u>RESERVOIR</u>	<u>RESERVOIR</u>	<u>WETFALL</u>
	<u>EVENT</u>	<u>BASE FLOW</u>	<u>SITES 1,2,3,4,6,7,8</u>	<u>SITES 5,8</u>	<u>DRYFALL</u>
DEPTH			X1	X1	
FLOW	X	X			
SECCHI DISC			X	X	
WATER TEMPERATURE	X	X	X1	X1	
DISSOLVED OXYGEN (Given as mg/L & % saturation)	X	X	X1	X1	
CONDUCTIVITY	X	X	X1	X1	
pH	X	X	X1	X1	X
OXIDATION REDUCTION POTENTIAL			X1	X1	
TOTAL PHOSPHORUS	X	X	X2	X3	X
ORTHO PHOSPHATE PHOSPHORUS	X	X	X2	X3	X
TOTAL KJELDAHL NITROGEN	X	X	X2	X3	X
OXIDIZED NITROGEN	X	X	X2	X3	X
AMMONIA NITROGEN			X2	X4	
TOTAL ORGANIC CARBON	1/QTR	1/QTR	X2, 1/QTR	X2, 1/QTR	
LEAD	1/QTR	1/QTR	X2, 1/QTR	X2, 1/QTR	
ZINC	1/QTR	1/QTR	X2, 1/QTR	X2, 1/QTR	
SUSPENDED SOLIDS/TURBIDITY	X	X	X2	X2	
CHLOROPHYLL a			X5	X5	
PHEOPHYTIN a			X5	X5	
ALGAE COUNTS			X5	X5	
FECAL COLIFORMS	X	X	X2	X2	

X1 - ONE METER INTERVALS

X2 - SURFACE SAMPLING ONLY

X3 - DISCRETE SAMPLES OF EPILIMNION, METALIMNION, METALIMNION, AND HYPOLIMNION WHEN STRATIFICATION EXISTS OR SURFACE, MID-DEPTH, AND NEAR BOTTOM WHEN NO STRATIFICATION PRESENT

X4 - DISCRETE SURFACE AND NEAR BOTTOM SAMPLES

X5 - A COMPOSITE OF BENEATH SURFACE, ½ SECCHI DEPTH, AND 1-1/2 SECCHI DEPTH SAMPLES

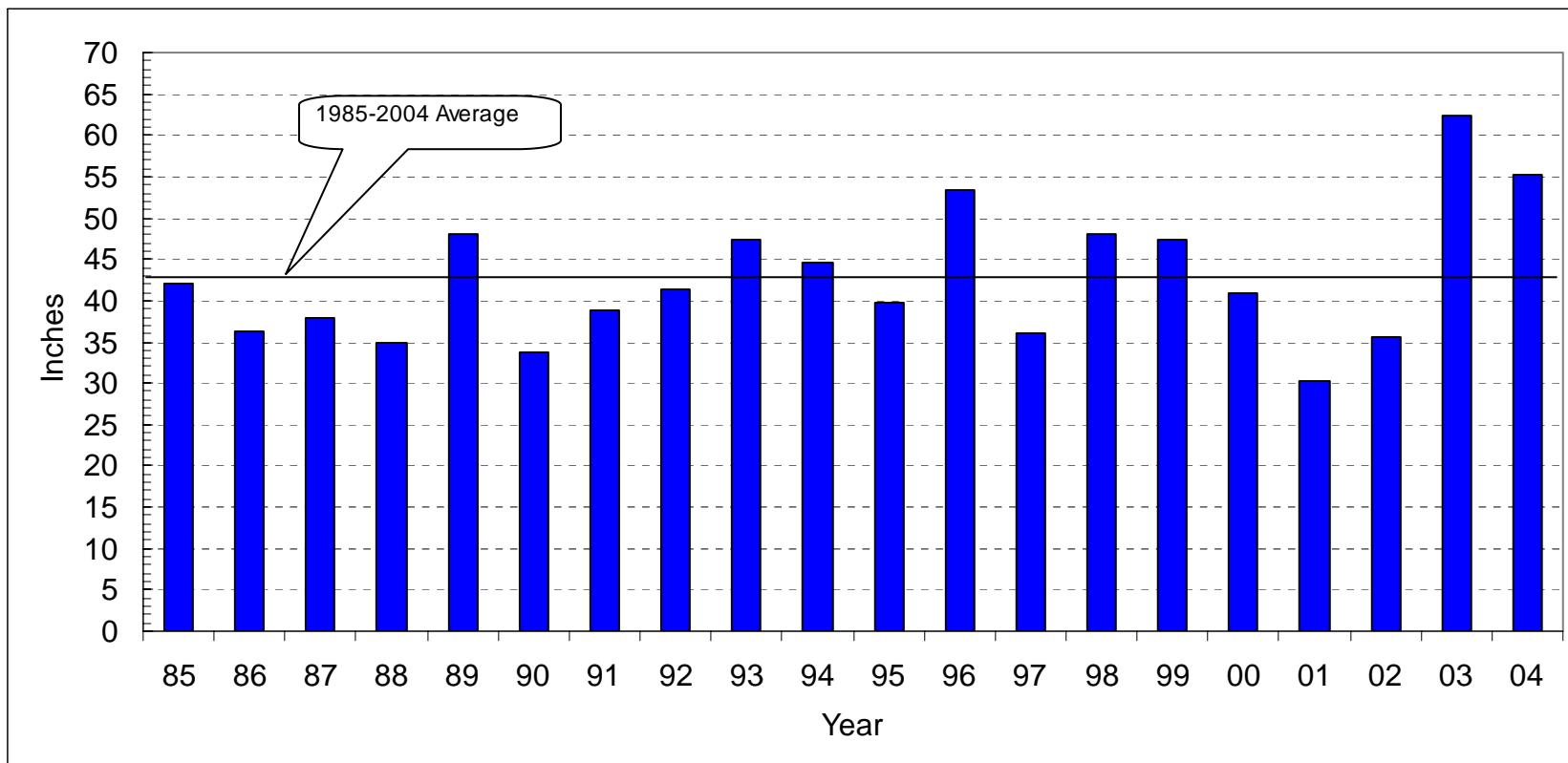
Table 1-3. Parameters And Analytical Methods

Parameter	Analytical Method	Detection Limit¹
Depth Dissolved Oxygen Oxidation Reduction Potential Water Temperature Conductivity pH	Probe: Hydrolab MiniSonde Probe: Hydrolab MiniSonde Probe: Hydrolab MiniSonde Probe: Hydrolab MiniSonde Probe: Hydrolab MiniSonde Probe: Hydrolab MiniSonde Probe: Hydrolab MiniSonde	± 0.08 m* ± 0.2 mg/L* ± 20mV* ± 0.1 °C* ± 0.001 µmhos/cm* ± 0.2 units*
Stage Flow Secchi Depth	USGS Staff Gauge Flowmeter: ISCO, Bubble-line 20 cm Standard Secchi Disk	± 0.01 ft* ± 0.001m ³ /s* ± 0.1 ft*
Total Phosphorus Orthophosphate Total Kjeldahl Nitrogen Oxidized Nitrogen Ammonia-N Total Organic Carbon	Skalar:EPA Approved, Autom. Skalar:EPA Approved, Autom. Skalar:EPA Approved, Autom. Skalar:EPA Approved, Autom. Hach, Salicylate Method 2460 Standard Methods, 5310C	0.005 mg/L 0.005 mg/L 0.05 mg/L 0.01 mg/L 0.03 mg/L 0.5 mg/L
Lead Zinc Total Suspended Solids	EPA 200.9, Platform Furnace EPA 289.1, Flame Standard Methods, 2540D	2.5 µg/L 50 µg/L 1.0 mg/L
Chlorophyll a Pheophytin Algae Counts Fecal Coliform Density Macroinvertebrate Assessments	Standard Methods, 10200H-3, Fluorom. Standard Methods, 10200H-3, Fluorom. Standard Methods, 10200F Standard Methods, 9222B EPA Rapid Bioassessment Protocol II	1.0 µg/L 1.0 µg/L 1 cell/mL 100col/mL N/A
Stream Gauging	USGS methodology	0.01 cfs*

NOTE: Standard Methods for the Examination of Water and Wastewater, 19th Edition.

* When Reporting Limit based upon detection is not an applicable measurement for a parameter, it has been replaced by an estimation of accuracy (e.g. pH measurement has an estimated accuracy of 0.2 units).

**Figure 1-2. Total Annual Rainfall Recorded Estimated for Swift Creek Reservoir Watershed from 1985-2004.
(Average 1985-2004)**



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An EPA performance evaluation of blind nutrient samples in a split sampling study is performed annually. Reported concentrations for orthophosphate and total phosphorus, ammonia, oxidized nitrogen, and total Kjeldahl nitrogen continue to be within the limits of the EPA's acceptable analytical values. The nutrient concentrations of the blind samples are of a higher concentration than normally found in our survey program samples. However, as of yet we are not aware of any SRM manufacturer who provides lower concentration blind samples.

Manufacturers' recommended preventive maintenance procedures were followed for all instruments.

All water quality data can be found in Appendices A and B. Algal data can be found in Appendix C.

Evaluation of the 2004 Water Quality

KCI Technologies, Inc. provided an assessment of the 2004 water quality data, with limited comparisons to historical data collected under this program.

RESERVOIR WATER QUALITY DATA ASSESSMENT

The eight stations in the reservoir were sampled at least monthly. Stations 8 and 5 were sampled twice per month. Sampling included surface water quality grab samples, a profile of physical parameters, and bottom water quality samples.

Currently the County has a water quality goal for phosphorus where the annual median concentration of total phosphorus (TP) in the surface waters should not exceed 0.05 mg/L. This goal was based on a Nutrient Controls Standards Workshop held in 1987 by the Department of Environmental Quality (formerly the State Water Control Board). This goal was the best available information for a nutrient standard for a reservoir.

In September 2005, DEQ proposed freshwater nutrient standards for 116 lakes and reservoirs in Virginia, including Swift Creek Reservoir. The proposed regulations have set Chlorophyll a and TP criteria for Swift Reservoir at 35 ug/L (0.035 mg/L) and 40 ug/L (0.040 mg/L), respectively. DEQ would consider the reservoir nutrient enriched if the median concentration of chlorophyll a in surface waters of the main body of the reservoir exceeds the criteria for two consecutive years. DEQ would consider the reservoir nutrient enriched if the median concentration of TP in surface waters of the main body of the reservoir exceeds the criteria for two consecutive years. The TP criteria would only be used if algicides were being used, thus making the chlorophyll a measurements unreliable.

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In Swift Creek Reservoir, algicides are used to spot treat algal blooms, so chlorophyll a measurements could be depressed. Algicide use is variable over the reservoir, between months, and between years. Because of the algicide use, analysis of the reservoir data should look at both TP and Chlorophyll a criteria.

During 2004, approximately 2,000 pounds of copper sulfate was used over five separate occasions to treat algae blooms in the reservoir. The water intake tower bay was treated four times, the Woolridge Road causeway area once, and the Hull Street shoreline area once.

Chlorophyll a

DEQ has identified Chlorophyll a as the most important parameter that can be measured to determine the nutrient enrichment status of a reservoir. Chlorophyll a, a green plant pigment found in algae, is a direct measure of biological response to nutrient loadings. DEQ considers a median concentration of 35 ug/L, between April and October (i.e. the growing season), to be the threshold for nutrient enriched for Swift Creek Reservoir.

The growing season median for all stations was 8.1 ug/L, well below the 35 ug/L threshold. Site 1 showed a peak in Chlorophyll a in the spring, but below the DEQ criteria. The Chlorophyll a concentrations of stations near tributaries should be monitored as possible early indicators of nutrient enrichment.

After Tropical Storm Gaston (08/30/04), four of the reservoir stations experienced Chlorophyll a concentrations near or exceeding 25 ug/L. These elevated concentrations continued well into October, and somewhat into November. Algal samples from October identified *Anabaena* and *Microcystis* blooms at Station 2, between Station 4 and 5, and at the intake bay. These particular algae result in odor and taste problems for the water treatment plant. While these concentrations are not above the DEQ criteria, they were well above the concentrations observed during the rest of the growing season.

The increased Chlorophyll a concentrations in the fall could be attributed to the increased loadings due to Tropical Storm Gaston. However, see the discussion on TP concentrations measured in the tributaries. Local sources of P loadings not related to Tropical Storm Gaston may have also contributed to the elevated Chlorophyll a levels in the fall.

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Table 1-4. Growing Season Chlorophyll a Concentrations (ug/L)
2004 Reservoir Sampling

	04/06	05/05	06/01	06/28	07/12	07/30	08/18	09/21	10/12	Growing Season Median	MAXIMUM
SITE 1	1.8	3.8	17.5	31.2	19.2	*	14.8	11.0	12.1	13.5	31.2
SITE 2	1.8	2.2	12.1	11.9	8.1	*	17.3	11.1	12.0	11.5	17.3
SITE 3	1.3	2.3	7.6	12.6	5.2	*	15.5	6.1	15.4	6.9	15.5
SITE 4	2.6	3.4	4.0	5.0	4.6	*	9.6	26.9	33.3	4.8	33.3
SITE 5	4.2	4.0	6.4	7.6	3.6	8.9	16.1	23.7	25.6	7.6	25.6
SITE 6	7.6	3.0	4.3	8.0	3.5	16.3	14.3	25.0	31.6	8.0	31.6
SITE 7	3.6	2.3	3.7	6.2	7.1	16.5	11.1	29.4	19.7	7.1	29.4
SITE 8	4.5	4.4	6.7	7.3	2.1	14.0	15.7	13.3	20.5	7.3	20.5
MONTHLY MEDIAN	3.1	3.2	6.6	7.8	4.9	15.2	15.2	18.5	20.1	8.1	

*Sampling was not conducted at Sites 1-4 on 07/30/04 therefore no data is shown.

Total Phosphorus (TP in mg/L)

Total phosphorus is often measured as an indicator of nutrient pollution. The County has a goal of 0.05 mg/L in order to maintain water quality. DEQ has proposed a freshwater nutrient standard of 40 ug/L (i.e. 0.040 mg/L) for the growing season. Both of these criteria are useful in assessing the nutrient enrichment status of the reservoir. The growing season (April – October) average TP concentrations for each reservoir station are provided in the following table:

**Table 1-5. Growing Season Median Total Phosphorus Concentrations
2004 Reservoir Sampling**

STATION	GROWING SEASON MEDIAN TOTAL PHOSPHORUS (mg/L as P)
1	0.050
2	0.032
3	0.021
4	0.026
5	0.022
6	0.017
7	0.022
8	0.022
All Stations	0.026

The reservoir is below the County goal and DEQ freshwater nutrient standard. The majority of individual stations and the reservoir as a whole have median growing season TP concentrations at that are well below the standard. However, after Tropical Storm Gaston, 5 out of 10 measurements of TP were above 0.05 mg/L. Reservoirs, being dammed rivers, tend to accumulate pollutants near the mouths of tributaries, and show a down reservoir decline in pollutant concentrations. A down reservoir trend is seen in TP concentrations along the following progression of Stations 1-2-4-5-8. Station 1 does exhibit a median growing season TP concentration above the proposed DEQ standard.

A significant increase in TP in anoxic, or oxygen depleted bottom waters indicates active phosphorus release from the sediments. The benthic release of P results in an additional loading to the reservoir, as this P is mixed with the upper water layers during de-stratification. In June 2004, the deepest and most anoxic station (#8) showed signs of a benthic release of

phosphorus. The TP concentration at the surface and the bottom were 0.010 and 0.048 mg/L, respectively. The frequency, magnitude and extent of elevated P concentrations in bottom waters should be evaluated over time to determine if this source of phosphorus is becoming more prevalent.

Dissolved Oxygen

For non-tidal freshwaters the state standard needed to support aquatic life is a daily average of 5.0 mg/L of dissolved oxygen. Hypoxic conditions (low oxygen levels) occur when dissolved oxygen dropped below 5 mg/L, resulting in stress on fish and other aquatic life. An anoxic condition (a lack of oxygen) occurs below 1 mg/L, and can result in fish kills, and the release of phosphorus, iron, manganese, and other elements from the sediments. These elements can result in increased algal blooms, and odor/taste and treatment problems for drinking water.

Thermal stratification is a natural process in many lakes and reservoirs that occurs when summer weather conditions warm the upper water column. The surface waters become lighter than the colder and denser bottom waters, resulting in a two separate layers of water separated by a sharp thermocline that inhibits vertical mixing. The thermal stratification typically continues until falling temperatures cool the surface water sufficiently to break up the thermocline. Often a large fall storm event will result in a rapid de-stratification of the lake.

Thermal stratification started in Swift Creek Reservoir in early May at Station 8 showing both a thermocline and a significant drop in dissolved oxygen. By the end of May, Station 5 in the main body of the reservoir also showed a drop in dissolved oxygen. In June, 5 of the 8 stations showed thermal stratification and low oxygen levels. By July, all of the stations were experiencing hypoxia below the thermocline. The deeper stations experience anoxic conditions. The most extreme conditions were reached at Station 8, near the water intake, in mid-July when 12 feet of the lower water column was anoxic -- incapable of supporting life. Stratification continued through August until Tropical Storm Gaston de-stratified the reservoir.

DEQ has recently proposed to EPA that the dissolved oxygen standard be modified to account for naturally occurring decreases in dissolved oxygen due to thermal stratification in reservoirs. The standards would apply to the entire water column when the reservoir is well mixed and only to the surface waters (epilimnion when the water column is vertically stratified). Swift Creek Reservoir is listed on the EPA 303(d) listing of impaired water bodies for not meeting the dissolved oxygen standard due to naturally occurring conditions. The revision of the state standards would remove Swift Creek from the EPA 303(d) listing of impaired waterbodies.

TRIBUTARY WATER QUALITY DATA ASSESSMENT

DEQ is developing nutrient criteria for streams which may be available in 2007. While there are no standards or criteria specific to streams, the TP criteria used for reservoirs provides a guideline against which to compare the tributary data.

Total Phosphorus

The County has a reservoir concentration goal of 0.05 TP mg/L in order to maintain water quality. In order to achieve this threshold, the phosphorus concentrations in the tributaries, which are main sources of phosphorus to the reservoir, should be tracked over time to identify increasing trends in concentrations and loadings. Not all TP is biologically available, some of it is bound to sediment particles. Orthophosphate is the dissolved phosphorus available in the water column to support biological activity, which includes algae blooms.

During the growing season, tributaries typically experience an average baseflow TP concentration of less than 0.04 mg/L, and a storm flow concentration of between 0.04 and 0.13 mg/L. These values are well below the Reservoir TP threshold.

**Table 1-6. Annual Median Phosphorus Concentrations
2004 Tributary Sampling**

STATION	TOTAL PHOSPHORUS (mg/L as P)		ORTHOPHOSPHATE PHOSPHORUS (mg/L as P)	
	Baseflow	Stormflow	Baseflow	Stormflow
1	0.02	0.06	0.007	0.014
2	0.03	0.09	0.007	0.025
3-I	0.02	0.04	0.006	0.010
3-II	0.03	0.04	0.005	0.009
4	0.02	0.03	0.006	0.008
5	0.04	0.04	0.014	0.014
6	0.02	0.07	0.003	0.007
7	0.02	0.06	0.003	0.012
8	0.04	0.05	0.007	0.013
13	0.02	0.04	0.005	0.014
14	0.01	0.13	0.005	0.025
Median	0.02	0.05	0.005	0.011

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The two stations in developed neighborhoods adjacent to the reservoir (13 – Brandermill, and 14 – Woodlake) have base flow TP concentrations similar to the larger, relatively undeveloped tributaries (i.e. Otterdale Branch). However, during storm events on October 18th, and November 8th, 2004, the TP and Orthophosphate concentrations were substantially elevated compared to the other tributaries. The following results from two fall storm events illustrate the observed phosphorus loadings from Stations 13 and 14.

Table 1-7. Phosphorus Concentrations for Fall Storm Events

	10/18/04 Storm Event		11/8/04 Storm Event	
	TP (mg/L)	OrthoP (mg/L)	TP (mg/L)	OrthoP (mg/L)
Station 13 - BranderMill	0.53	0.271	0.84	0.669
Station 14 - Woodlake	0.49	0.182	0.46	0.166
Average of Other Stations	0.03	0.017	0.05	0.01

The above results indicate that developed areas are contributing a significantly higher concentration, and loading of P to the reservoir than are the undeveloped watersheds. A substantial amount of the TP during the above storm events was dissolved (i.e. OrthoP), which could be derived from fertilizers.

Nitrogen

While phosphorus tends to be the primary nutrient of concern in freshwater monitoring programs, increased levels of nitrogen can also indicate degradation in water quality. Oxidized nitrogen, primarily nitrate, if elevated, may indicate inputs of fertilizers. Nitrate can be carried by both surface runoff, as well as, groundwater. Total Kjeldahl Nitrogen includes organic nitrogen and ammonia (NH₄), which may be high if there are loadings of organic pollutants or ammonia based fertilizers.

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During the growing season, the stations tend to have baseflow median TN concentrations of 0.30 to 0.55 mg/L. Station 14 has a baseflow median of 0.73 mg/L TN, higher than the other stations. During storm events, the tributary stations (1 to 8) tend to increase 50-100% over the baseflow concentrations, in the range of 0.51-0.79 mg/L. Median TN concentrations during storms at Stations 13 and 14 were 1.34 and 1.55 mg/L, respectively, well above the tributary stations. A substantial amount of that difference appears to be due to elevated oxidized nitrogen concentrations. Stations 13 and 14 are up to an order of magnitude higher in oxidized nitrogen compared to the tributary stations on the less developed watersheds (i.e. 4-Otterdale, 3I- Horsepen).

**Table 1-8. Annual Median Nitrogen Concentrations
2004 Tributary Sampling**

STATION	TOTAL NITROGEN (mg/L as N)		TOTAL KJELDAHL NITROGEN (mg/L as N)		OXIDIZED NITROGEN (mg/L as N)	
	Baseflow	Stormflow	Baseflow	Stormflow	Baseflow	Stormflow
1	0.43	0.66	0.41	0.62	0.04	0.06
2	0.47	0.75	0.39	0.60	0.09	0.13
3-I	0.34	0.51	0.34	0.50	0.01	0.01
3-II	0.35	0.53	0.35	0.52	0.01	0.01
4	0.29	0.54	0.27	0.53	0.02	0.02
5	0.45	0.57	0.39	0.53	0.04	0.03
6	0.43	0.70	0.34	0.58	0.07	0.12
7	0.40	0.79	0.30	0.54	0.10	0.20
8	0.55	0.73	0.53	0.72	0.01	0.01
13	0.50	1.34	0.43	0.78	0.14	0.45
14	0.73	1.55	0.28	0.90	0.44	0.66
Median	0.44	0.65	0.35	0.58	0.03	0.06

Chapter 2: Phosphorus Load Estimation

PHOSPHORUS LOAD ESTIMATION

The Regression method (Leitch, 1998) was used to determine phosphorus loadings to Swift Creek Reservoir in 2004. This regression method utilizes the relationship between the logarithms of tributary total stormflow or baseflow (ft^3) and storm or baseflow total phosphorus load (pounds) to derive the annual total phosphorus load from the individual tributaries (See Figures 2-1a through 2-1c). This relationship has been determined by Leitch (1998) to most accurately represent the annual total phosphorus loading to Swift Creek Reservoir due to the pairing of actual baseflow and stormflow concentrations with their associated discharges. A modified version of the Leitch (1998) method (SCWTP 2000) was used for tributary and direct run-off phosphorus load estimations with scaling factors determined by Smock (1993) and USGS (1998) (Table 2-1).

Table 2-1. Sub-Basin Areas And Scaling Factors Of Swift Creek Reservoir Watershed As Determined From Data By Smock (1993) And USGS (1998)

Site Name	Site Number	Gauged Area USGS (sq. miles)	Total Adjusted Area (sq. miles)	Scaling Factor
Tributaries				
Dry Creek	1	2.96	3.85	1.30
Westbranch	2	2.75	2.75	1.00
Horsepen Creek	3-I	3.72	4.39	1.18
Blackman Creek	3-II	5.80	6.61	1.14
Otterdale Branch	4	3.59	4.63	1.29
Swift Creek	5	21.40	23.27	1.09
Tomahawk Creek	6	4.20	5.94	1.41
Little Tomahawk Creek	7	2.31	3.21	1.39
Ashbrook Creek	8	2.37	2.56	1.08
Direct Runoff				
Chimney House Place	13	0.05	2.54	50.80
Chestnut Bluff Terrace	14	0.19	2.12	11.16

Baseflow total phosphorus loads were determined from grab sample concentrations and corresponding instantaneous discharges scaled to a 24 hour period (daily load). Storm event phosphorus concentrations were acquired by flow-weighted composite sampling of stormflows at each tributary and direct runoff site. The total flow volume was then applied to the event mean concentration (mg/L) of the storm to determine the event phosphorus load.

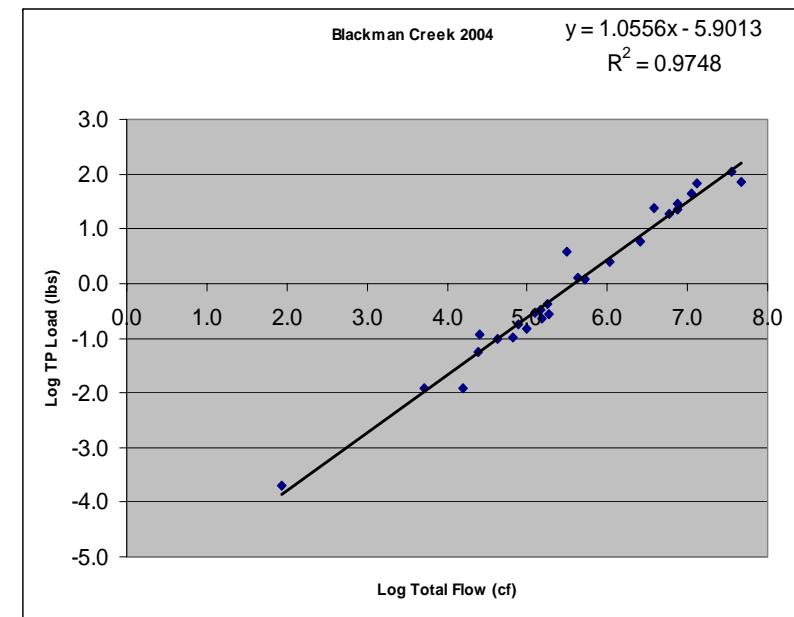
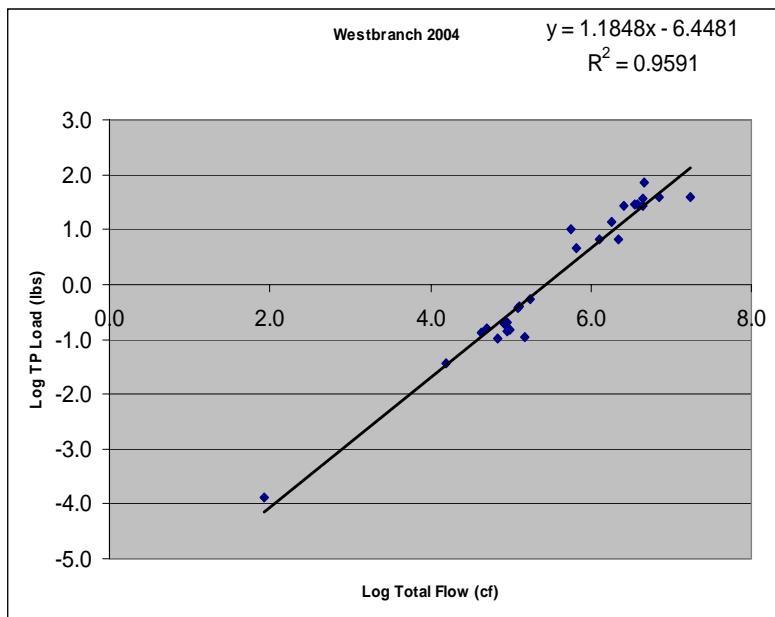
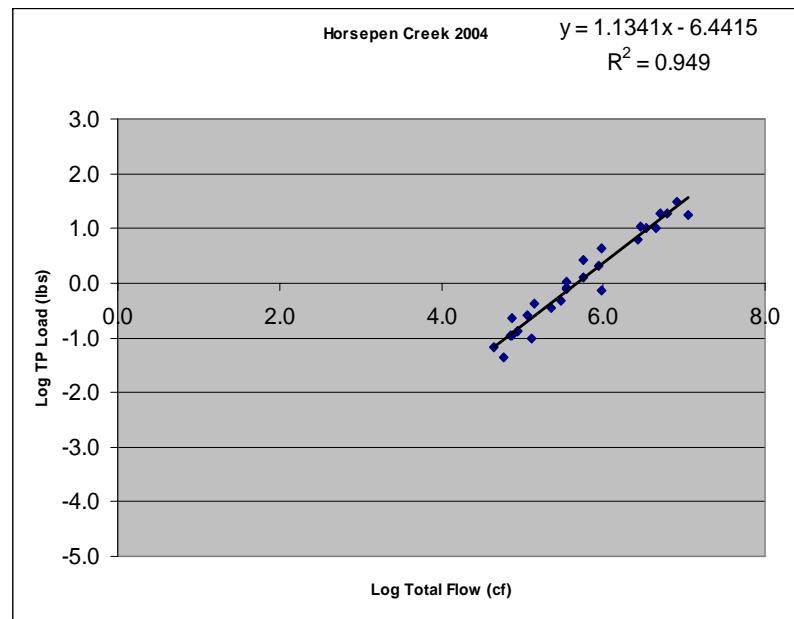
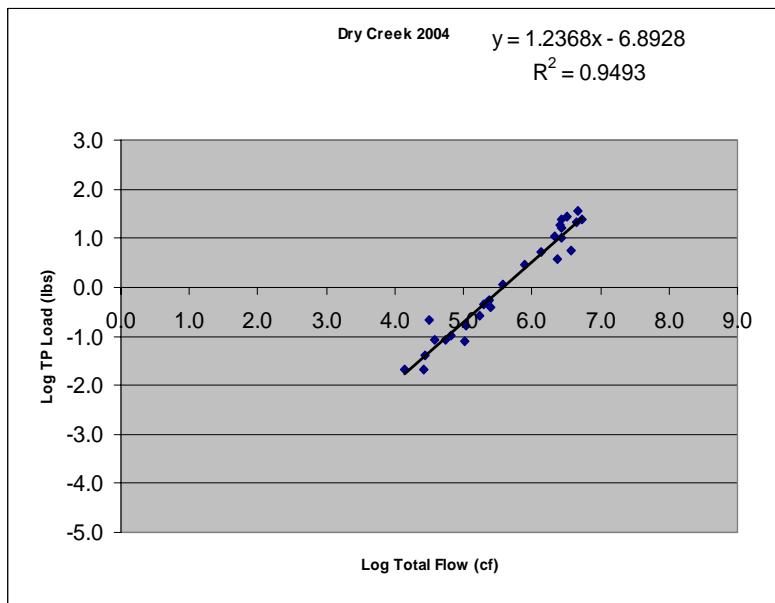


Figure 2-1a. Relationships of total flow volume versus total phosphorus load in the tributaries of Swift Creek Reservoir (Regression Method 2000).

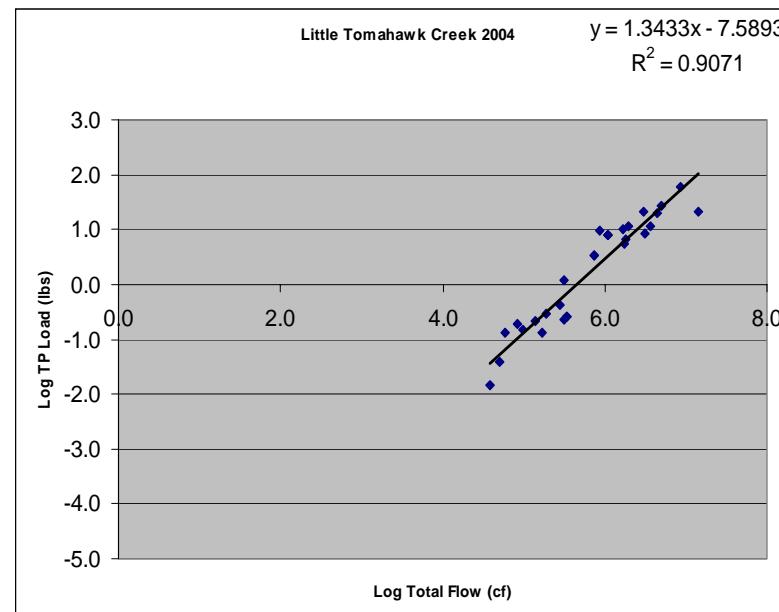
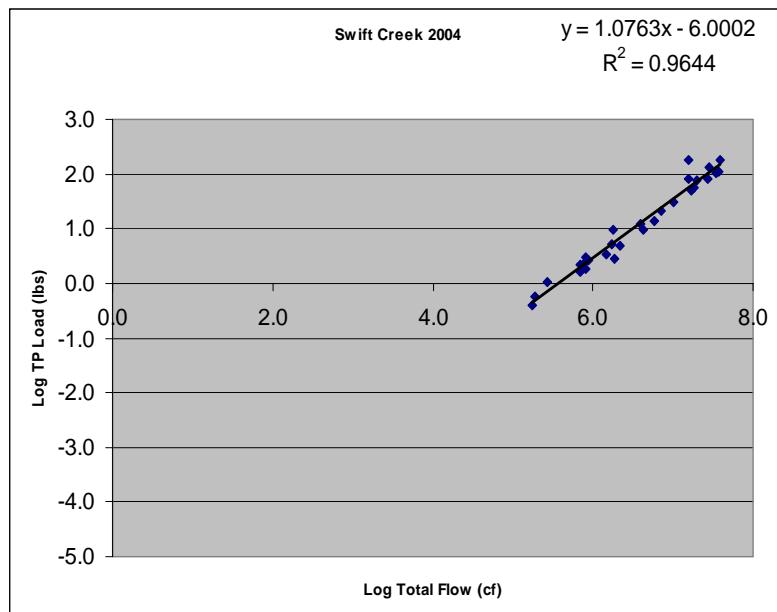
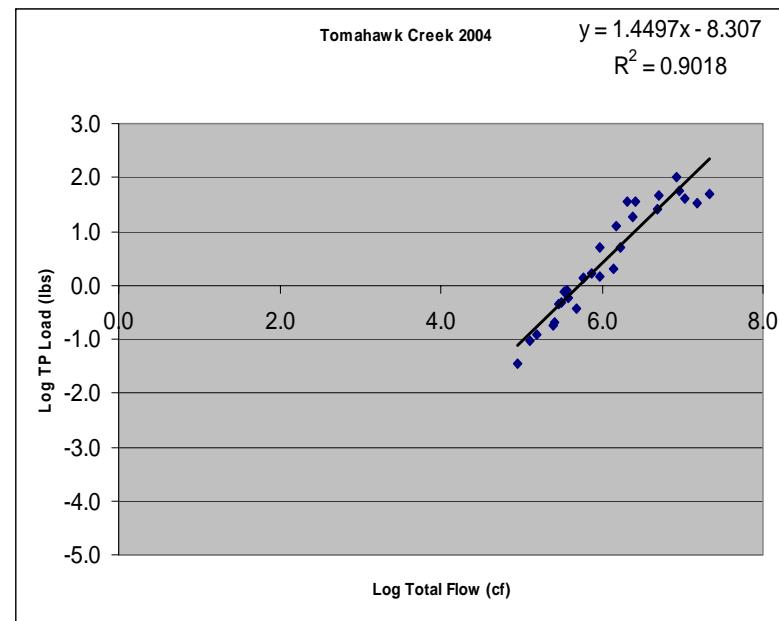
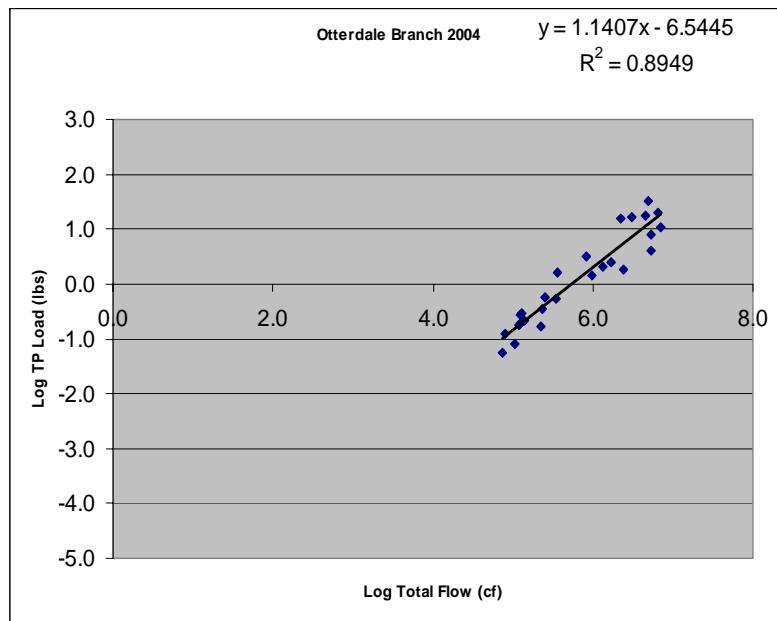


Figure 2-1b. Relationships of total flow volume versus total phosphorus load in the tributaries of Swift Creek Reservoir (Regression Method 2000).

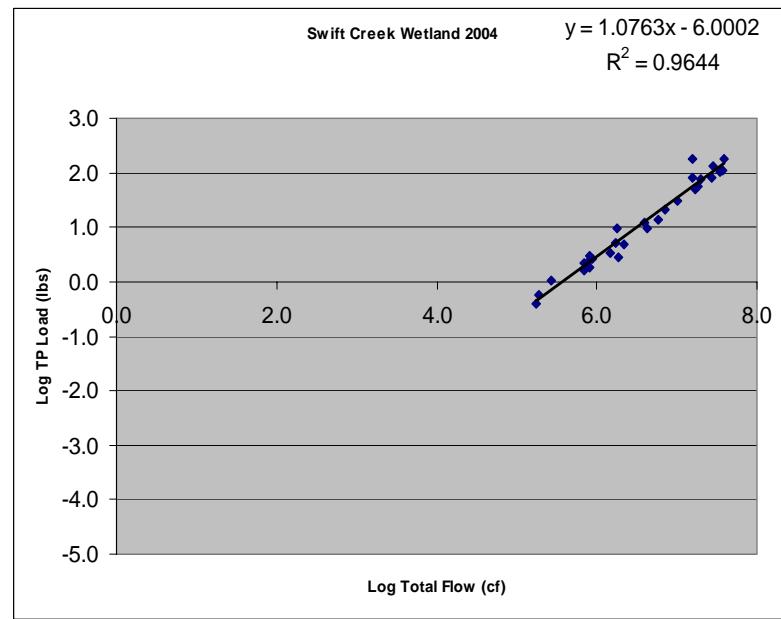
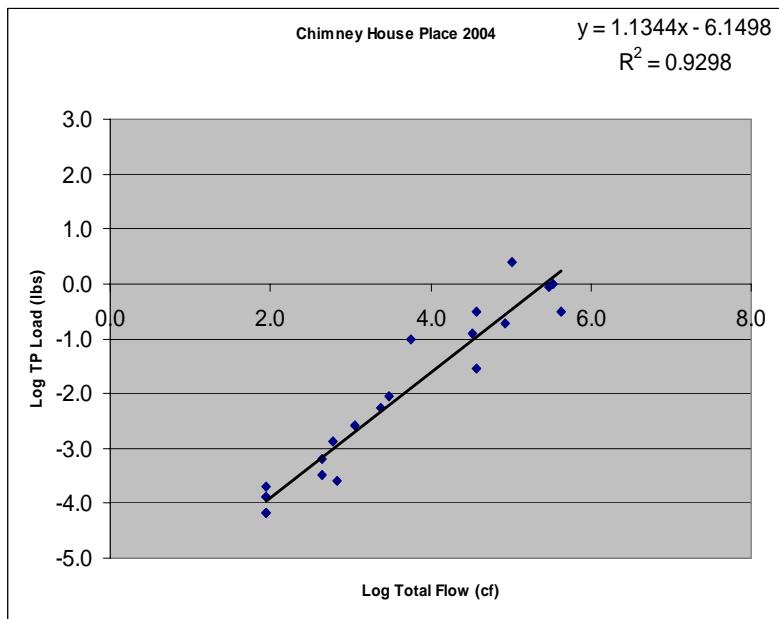
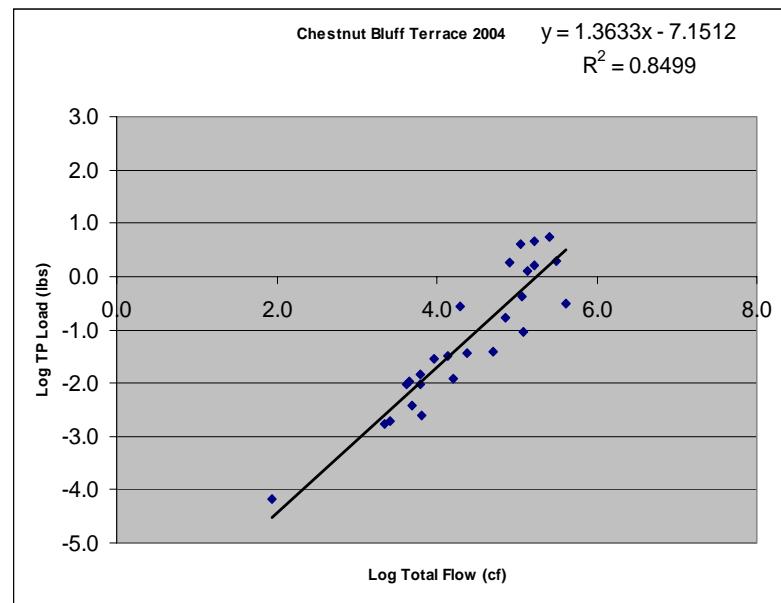
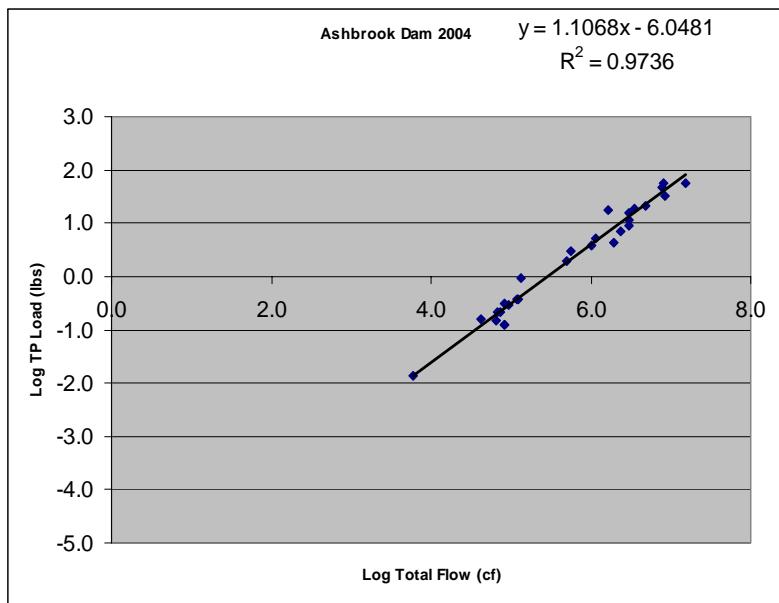


Figure 2-1c. Relationships of total flow volume versus total phosphorus load in the tributaries of Swift Creek Reservoir (Regression Method 2000).

Atmospheric phosphorus inputs were measured from Wetfall/Dryfall sampling. The average concentration and average daily loadings for the wetfall and dryfall are summarized in Table 2-2. A test for outliers was conducted on the results, which indicated that two wetfall loadings were outliers (>2.5 sd from the mean) and removed from further analysis. The Seasonal Loadings for wetfall and dryfall were tallied to determine an annual phosphorus loading from atmospheric sources (Table 2-3).

Table 2-2. Results of the Wetfall – Dryfall Phosphorus Monitoring

Parameter	Mean	SD	n
Wetfall Concentration (mg/L)	0.14	0.167	20
Wetfall Loading (mg/m ² /day)	5.04	7.195	20
Dryfall Concentration (mg/L)	0.67	0.647	15
Dryfall Loading (mg/m ² /L)	0.42	0.469	15

Outliers: Wetfall P Loadings Jul 29=23.15 mg/m²/day; Aug 25 = 23.19 mg/m²/day

Table 2-3. Seasonal Atmospheric Total Phosphorus Inputs to Swift Creek Reservoir (2004).

	Wetfall Total			Dryfall Total		
	Phosphorus Load	Rainfall		Phosphorus Load	Dryfall Period	
Season	(lbs)	(inches)	n	(lbs)	(Days)	n
Winter	110	2.85	2	13	59	2
Spring	30	12.02	6	6	26	2
Summer	262	21.13	6	35	85	4
Autumn	378	7.46	7	36	73	6
Annual	780	43.46	21	89	243	14

Note: Some samples were excluded from loading calculations

Rainfall and dry fall days are less than actual annual totals

Total reservoir load was then determined by adding tributary and atmospheric inputs (Table 2-4). The procedure described above yielded a yearly total phosphorus load of 8,019 pounds. Annual phosphorus loads for 1992 through 2004 are given in Figure 2-2 and provided in Table 2-5. The 2004 estimate of phosphorus loadings is slightly above the long term average of annual loadings (8,019 lbs). Considering the near record high rainfall for 2004, the loading estimate is relatively low compared to the historical loadings. The high loading in 2003 reflects the record rainfall that year.

Table 2-4. Annual 2004 sub-basin phosphorus loads for Swift Creek Reservoir watershed as determined by the Regression Method (Leitch, 1998).

	Station	Raw Total Phosphorus Load	Scaled Total Phosphorus Load	% Contribution
Tributary	Number	(Pounds)	(Pounds)	
Dry Creek	1	248	323	4.0
West Branch	2	479	479	6.0
Horsepen	3-I	186	220	2.7
Blackman	3-II	688	784	9.8
Otterdale	4	188	242	3.0
Swift Creek	5	2,013	2,189	27.3
Tomahawk	6	502	710	8.9
Little Tomahawk	7	296	411	5.1
Ashbrook	8	455	492	6.1
Chimney House Place (Brandermill)	13	3.67	186	2.3
Chestnut Bluff Terrace (Woodlake)	14	13.33	149	1.9
Swift Creek Wetland	-	888	966	12.0
Watershed Subtotal		5,960	7,150	89.2
Atmospheric Inputs	Wetfall/Dryfall	869	869	10.8
Total Watershed Load 2004:		6,829	8,019	100.0

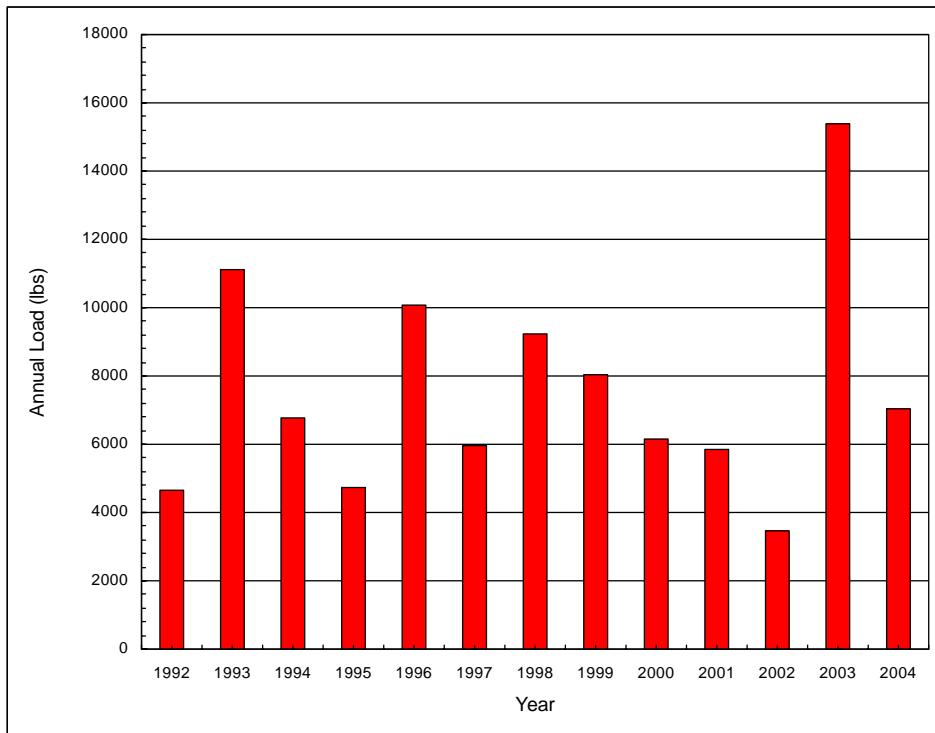


Figure 2-2. Annual Phosphorus Loadings To Swift Creek Reservoir.
 1992 & 1993 Data From Smock, 1994 – 1995 Values From OWML, 1996 Value From Hoehn Et Al.,
 1997 Value From SCWTP. The 1998 – 2004 Values Are Derived From The Regression Method
 Detailed By Lietch (1998).

Table 2-5. Summary of Annual Phosphorus Loadings

Year	Annual Estimated Phosphorus Loading (pounds)
1992	4,653
1993	11,100
1994	6,755
1995	4,750
1996	10,060
1997	5,976
1998	9,221
1999	8,048
2000	6,168
2001	5,859
2002	3,477
2003	15,376
2004	8,019

Chapter 3: Hydrology & Water Budget

HYDROLOGIC CHARACTERISTICS AND WATER BUDGET

Total hydrologic inputs and outputs were characterized to determine the 2004 water budget for Swift Creek Reservoir (Table 3-1). A detailed description of water budget procedures can be found in the 1998 Swift Creek Reservoir Survey Report (SCWTP, 2000). The 2004 water budget for Swift Creek Reservoir was determined from the following simplified water budget equation used in previous USGS reports (Skrobialowski, 1998):

$$\text{Input} - \text{Output} = \text{Change in Storage} + \text{Residual}$$

Where:

$$\text{Inflows} = \text{Surface water inflows} + \text{total precipitation volume}$$

$$\text{Outflows} = \text{Evaporation} + \text{withdrawals} + \text{overflow} + \text{seepage}$$

$$\text{Change in Storage} = \text{Measured change in reservoir storage during the year}$$

Residual = the sum of errors associated with assumed, estimated, and measured hydrologic characteristics + unaccounted for variables (*i.e.* groundwater flux and transpiration).

Inflows

Gauged inflow sites were categorized as main tributaries and residential catchments (Table 3-2). There are nine tributaries that drain mostly undeveloped or developing land in the watershed and two residential catchments that drain mostly developed land adjacent to the reservoir (Figure 3-1). Annual tributary inflows were 1689 Mft³. Drainage from a large wetland adjacent to the Swift Creek monitoring station was estimated from flow transducers installed in a culvert pipe resulted in an annual discharge of 284 Mft³. Annual hydrographs (Figures 3-2a through 3-2d) and mean daily discharge values and summary statistics are presented for each site in Tables 3-3a through 3-3k. Discharges from ungaged direct runoff areas adjacent to the reservoir were estimated as in previous USGS reports, except Areas 1 and 2, and totaled 418 Mft³ (Skrobialowski, 1998; Table 3-4). Direct Runoff Area 1 was calculated based on annual runoff from the Brandermill residential catchment and Direct Runoff Area 2 from the Woodlake residential catchment.

The mean precipitation for 2004 was calculated from an average of three tipping bucket rain gauges within the watershed as 55.23 inches (Table 3-5). The precipitation total for 2004

was the second highest recorded since the start of this monitoring program. The total direct precipitation on to the surface of the reservoir was about 326 Mft³ (Table 3-5).

Outputs

The total annual discharge over the dam in 2004 was 5,980 Mft³ (Table 3-1). Leakage under the dam was estimated at 0.0 Mft³ because direct gauging was not possible due to continual flow over the spillway (Table 3-1). The annual overflow hydrograph (Figure 3-2c) and mean daily discharge values and summary statistics for overflow and leakage are presented in Tables 3-6a through 3-6b.

The total volume of water withdrawn for the public water supply by Addison-Evans Water Production & Laboratory Facility plant was 401 Mft³ (Table 3-1). Brandermill Country Club withdrew a record low 1.0 Mft³ (Table 3-1) for golf course irrigation in 2004. Both of these volumes were within historical norms.

Evaporation from the reservoir determined from pan data was 35.1 inches for 2004 which represented approximately 152 Mft³ (Table 3-7). Pan evaporation for January was set to 0 Mft³ for the month of January due to frozen conditions. The evaporation estimate for 2004 was relatively high, although within the range of historical estimates made by this program. One factor that increases evaporation during a rainy year is the larger surface area of the reservoir available for evaporational loss.

Change in Reservoir Storage

The USGS developed elevation-storage rating derived from the 1995 reservoir bathymetric survey was used to determine the annual change of storage capacity of Swift Creek Reservoir. Storage was calculated as the difference between the volume of water in the reservoir on January 1, 2004 and December 31, 2004. Due to the high rainfall, the reservoir was at full pool at the beginning and end of the year, so there was no change in the volume.

The Residual and Explanation of Errors

The calculated residual was 3,817 Mft³ and represented the sum of errors associated with assumed, estimated, and measured hydrologic characteristics, as well as unaccounted for variables. A detailed explanation of errors associated with measurements and estimations regarding the calculation of water budgets are presented in the 1997 USGS report of hydrologic characteristics (Skrobialowski, 1998).

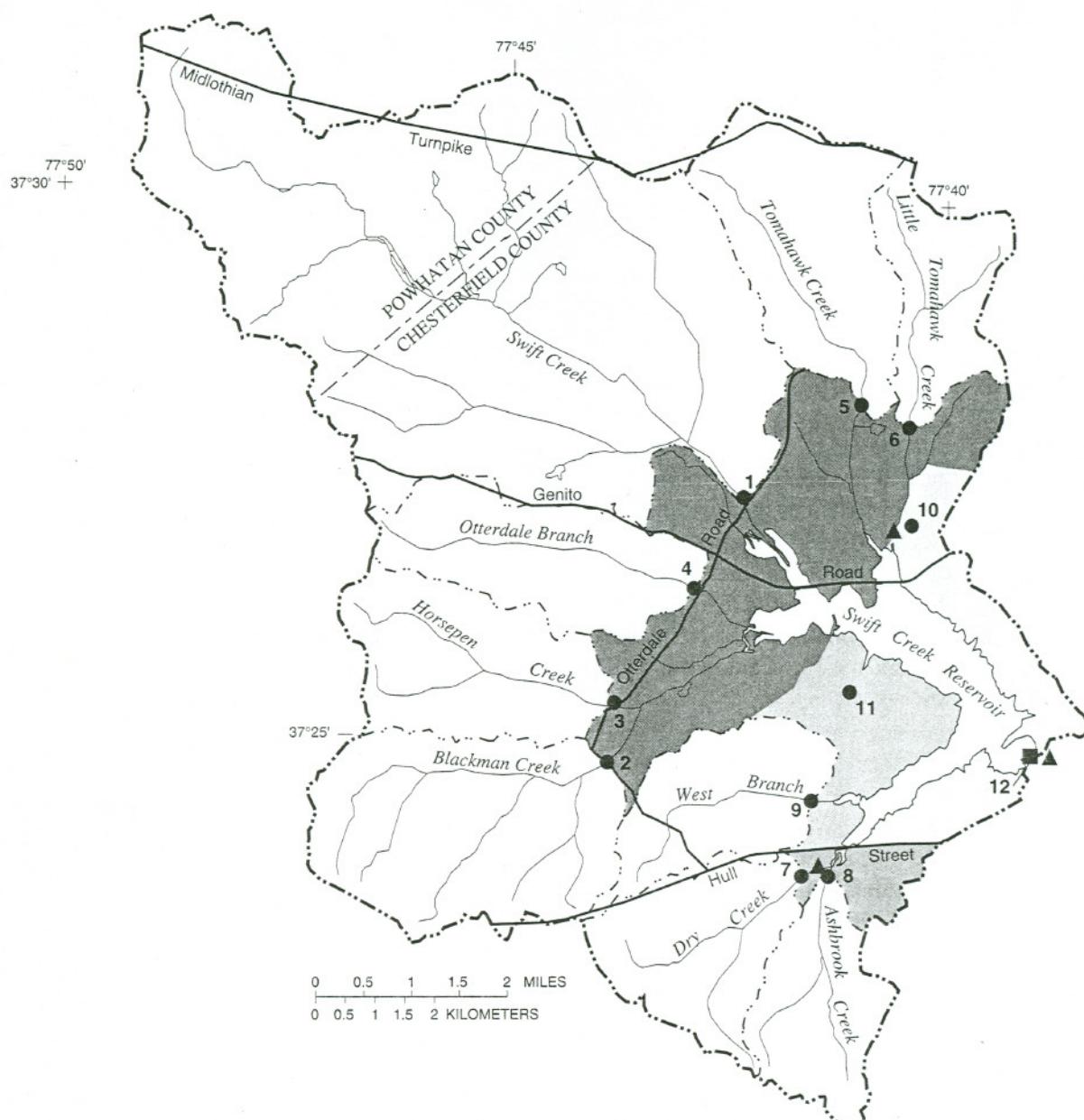
Table 3-1. 2004 Water Budget for Swift Creek Reservoir

Inputs	Mft³	Source
Monitored Tributaries	1,689	Stream Gauges (Table 3-2 & 3-3)
Direct Runoff Areas	418	Calculated as per USGS (Table 3-4)
Swift Creek Wetland Discharge	284	Based on velocity and stage measurements (Table 3-3i)
Precipitation	326	Scaled using mean rainfall and lake surface area (Table 3-5)
Total	2,717	
Outputs	Mft³	
Evaporation	152	Calculated on monthly basis using pan data and stage/s.a. curve from OWML
Plant Withdrawals	401	Determined from operator's log
Golf Course Irrigation	1	Acquired from Brandermill Country Club
Overflow	5,980	Determined from USGS rating tables and daily average reservoir elevations from automated gage.
Leakage	0	Determined from gauging below dam
Total	6,534	
Change in Storage	0	Calculated using intake gauge and USGS storage data regressed
Residual	3,817	Surplus Discharge over Dam

Table 3-2. Drainage Area, Discharge, and Runoff Data for Tributaries and Residential Catchments

	Station Number	Drainage Area	Average Daily Mean Discharge	Max Daily Mean Discharge	Min Daily Mean Discharge	Gauged Annual Flow	Annual Runoff
Tributary		(sq. miles)	(ft ³ /s)	(ft ³ /s)	(ft ³ /s)	(Mft ³)	Mft ³ /mi ²)
Dry Creek	1	2.96	2.78	28.70	0.00	87.67	29.6
Westbranch	2	2.75	3.39	65.73	0.00	106.91	38.9
Horsepen	3-I	3.72	2.78	71.76	0.50	87.67	23.6
Blackman	3-II	5.80	7.50	294.57	0.00	236.52	40.8
Otterdale	4	3.59	3.27	51.77	0.29	103.12	28.7
Swift Creek	5	21.40	20.40	199.65	0.94	643.33	30.1
Tomahawk	6	4.20	6.16	66.59	0.00	194.26	46.3
Little Tomahawk	7	2.31	3.55	65.81	0.18	111.95	48.5
Ashbrook	8	2.37	3.73	71.88	0.00	117.63	49.6
Total		49.10				1689.07	
Residential Catchments:							
Brandermill	13	0.05	0.06	1.80	0.00	1.76	35.1
Woodlake	14	0.19	0.15	1.42	0.01	4.73	24.9
Swift Creek Dam	Spillway	64.40	190.00	5727.00	15.12	5991.84	93.0

Figure 3-1 Sub-basins and data collection sites in the Swift Creek drainage basin. (From Skrowbialowski, 1998)



Base from U.S. Geological Survey
1:100,000 Digital Line Graph

EXPLANATION

[White Box]	DIRECT RUNOFF AREA 1	[Dashed Line]	DRAINAGE-BASIN BOUNDARY
[Light Gray Box]	DIRECT RUNOFF AREA 2	[Dashed Line]	SUBBASIN OF SWIFT CREEK BASIN
[Medium Gray Box]	DIRECT RUNOFF AREA 3	▲	RAIN GAGE
[Dark Gray Box]	DIRECT RUNOFF AREA 4	5 ● 12 ■	INFLOW SITE AND NUMBER (Table1) OUTFLOW SITE AND NUMBER (Table1)

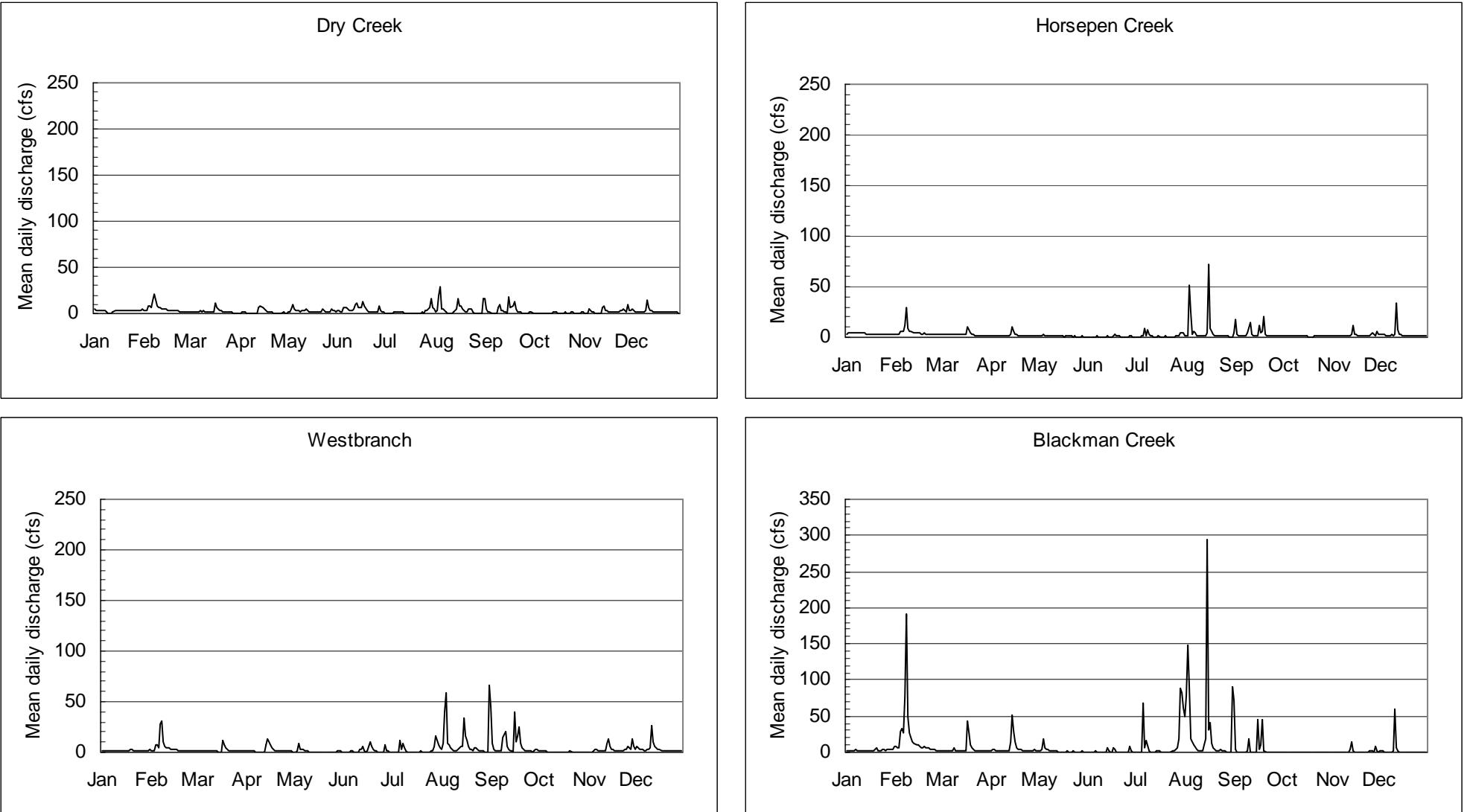


Figure 3-2a. 2004 discharge hydrographs for the western tributaries of Swift Creek Reservoir Watershed.

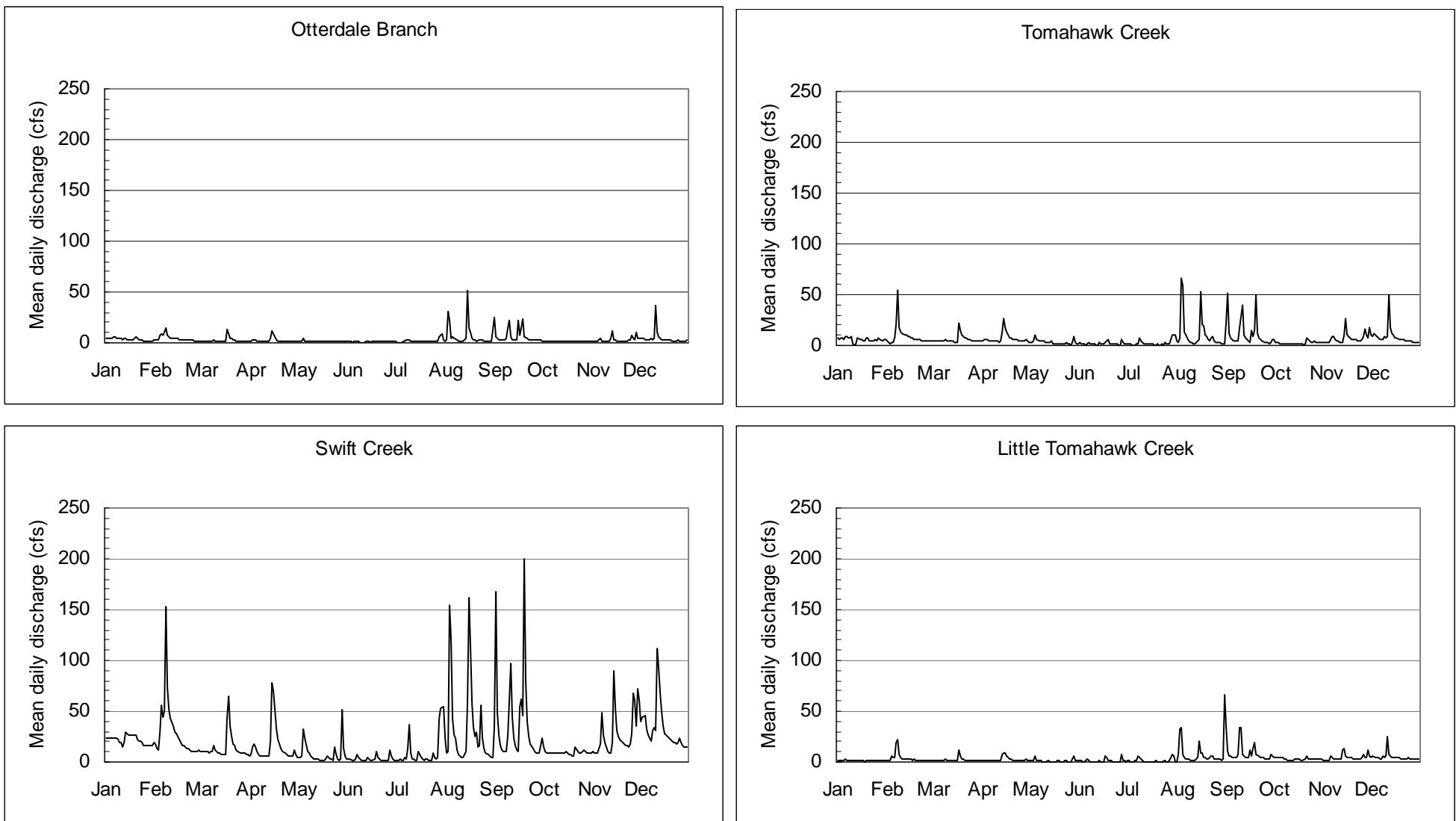


Figure 3-2b. 2004 discharge hydrographs for the northern tributaries of Swift Creek Reservoir Watershed.

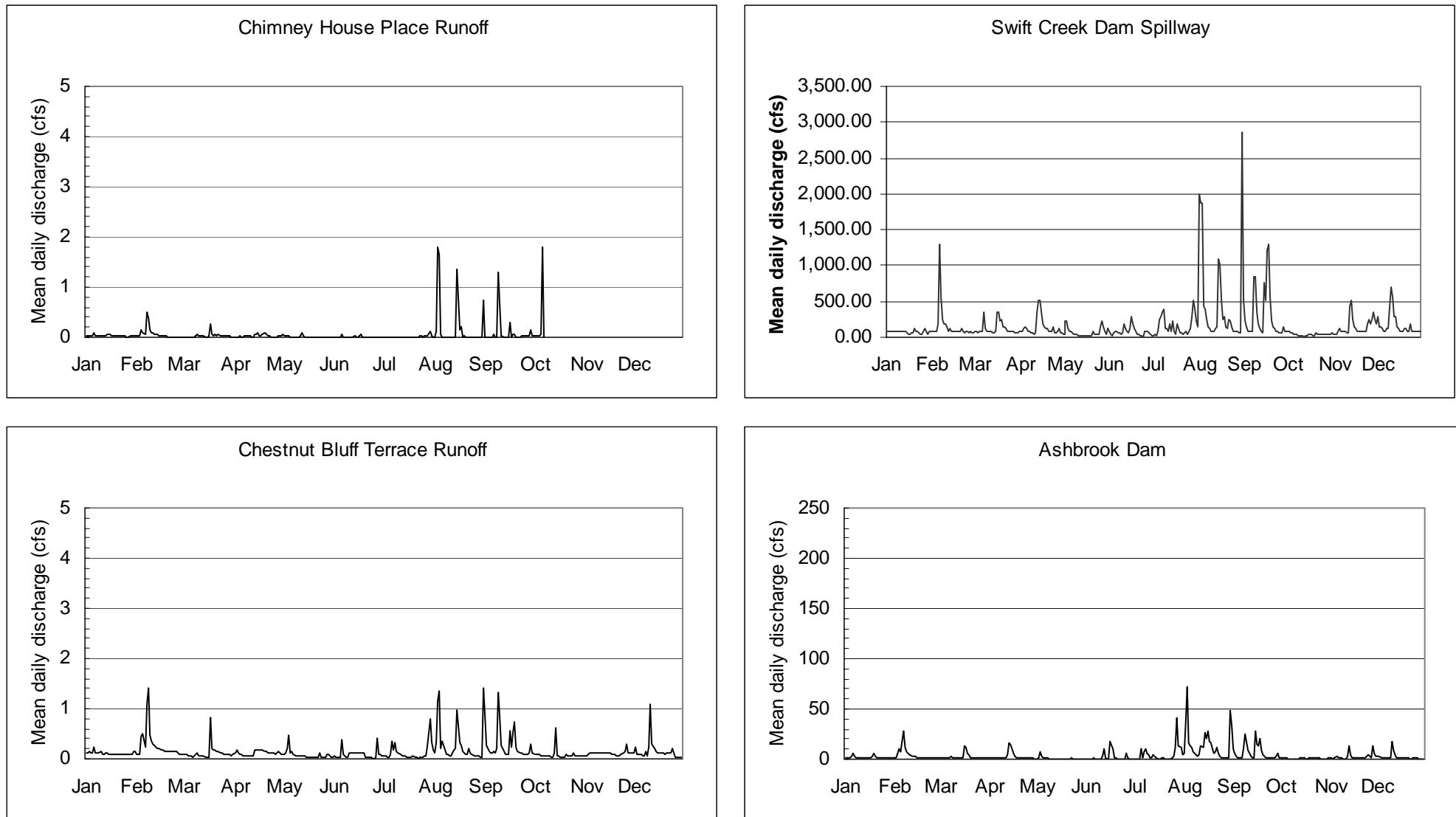


Figure 3-2c. 2004 discharge hydrographs for the direct runoff sites and impounded waters of Swift Creek Reservoir Watershed.

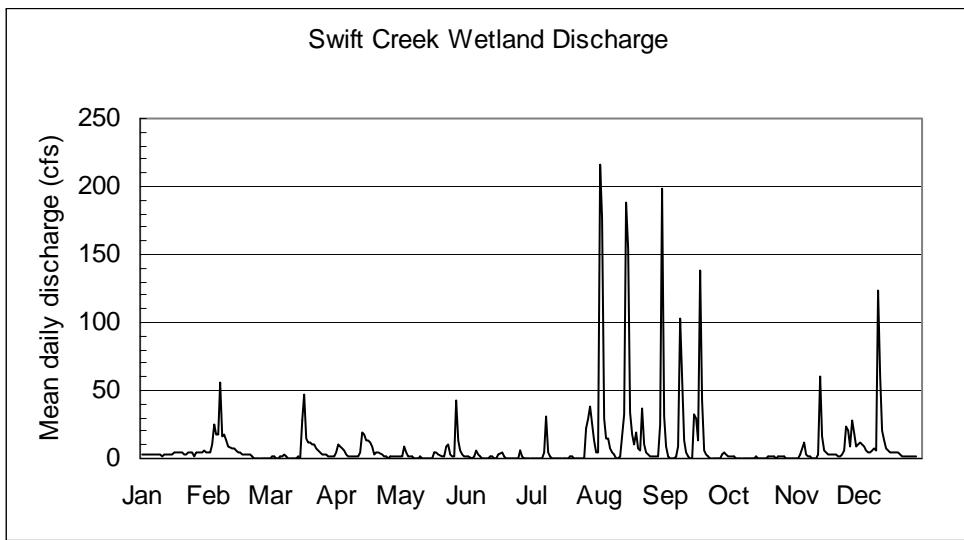


Figure 3-2d. 2004 discharge hydrographs for the direct runoff sites and impounded waters of Swift Creek Reservoir Watershed.

Table 3-3a. 2004 daily mean discharges (cubic feet/second) for sites within the Swift Creek Reservoir Watershed. Bold values indicate estimated flow.

Dry Creek

<u>Day</u>	<u>January</u>	<u>February</u>	<u>March</u>	<u>April</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>August</u>	<u>September</u>	<u>October</u>	<u>November</u>	<u>December</u>
1	4.26	3.53	1.57	0.26	1.06	3.27	0.72	1.91	16.35	0.66	0.91	2.58
2	3.83	2.83	1.67	2.39	2.02	3.37	0.03	3.39	4.06	0.24	0.76	4.33
3	3.81	2.76	1.83	1.29	4.20	1.86	0.06	18.81	1.88	0.13	0.70	2.91
4	3.81	7.31	1.78	1.13	10.12	1.36	0.04	28.70	1.04	0.12	0.80	2.32
5	3.81	7.29	1.58	0.74	5.19	6.27	0.53	4.83	0.66	0.11	5.41	1.90
6	3.81	6.15	1.19	0.20	3.82	6.14	2.18	4.19	0.31	0.04	3.08	1.49
7	3.81	13.89	2.68	0.09	3.52	4.66	1.53	2.71	0.66	0.01	1.34	1.24
8	3.81	21.11	2.41	0.09	2.58	3.87	1.57	1.01	0.25	0.01	1.07	2.40
9	1.14	7.99	3.84	0.08	2.39	3.27	1.53	0.32	6.76	0.00	0.69	1.65
10	0.02	6.30	2.17	0.09	2.71	2.64	1.49	0.04	9.67	0.00	0.72	3.85
11	0.02	5.73	1.42	0.09	2.81	5.47	1.35	0.00	3.73	0.01	0.56	13.86
12	0.02	5.15	1.23	0.09	4.47	9.58	0.83	0.98	2.50	0.01	0.36	5.74
13	1.21	4.87	1.28	6.02	2.52	11.91	0.13	3.84	1.31	0.01	7.21	3.81
14	3.02	4.67	1.13	8.58	1.80	6.75	0.09	4.13	0.91	1.35	8.37	2.86
15	3.02	4.33	1.16	6.57	1.44	6.14	0.09	16.92	0.51	1.06	3.59	2.12
16	3.02	4.02	1.23	4.77	1.40	6.08	0.09	8.22	17.37	0.69	2.43	1.67
17	3.02	3.49	11.25	2.62	1.25	12.13	0.09	7.83	6.51	0.29	1.90	1.45
18	3.02	3.07	6.17	1.71	1.36	7.68	0.09	4.37	8.18	0.10	1.43	1.40
19	3.02	3.20	3.42	1.18	1.40	3.57	0.09	3.72	12.86	0.06	1.21	1.27
20	3.02	3.03	2.63	1.02	1.35	1.42	0.09	2.21	4.33	0.13	1.16	1.23
21	3.02	2.81	1.65	0.82	1.26	1.19	0.09	1.05	2.13	1.41	1.11	1.08
22	3.02	2.64	1.34	0.76	1.24	1.20	0.09	4.43	1.39	0.29	1.06	1.01
23	2.50	2.29	1.26	0.41	4.40	1.14	0.20	4.10	0.96	0.14	1.08	1.07
24	2.69	2.09	1.36	0.16	2.09	1.14	1.02	1.16	0.58	0.09	2.82	2.09
25	3.18	2.24	1.36	0.26	1.42	1.17	0.34	0.41	0.30	1.04	3.39	2.21
26	2.82	2.07	1.28	0.08	1.27	1.26	2.91	0.09	0.20	1.03	5.51	1.30
27	3.98	1.79	1.04	0.20	2.03	7.62	3.07	0.02	0.09	0.61	2.79	1.13
28	3.41	1.64	0.09	1.52	5.15	3.03	5.67	0.00	0.37	0.51	1.74	1.02
29	3.23	1.54	0.09	0.44	3.88	2.06	15.93	0.00	2.38	0.49	9.66	0.84
30	3.55		0.09	0.21	3.23	1.39	6.61	0.00	1.67	0.58	3.79	0.92
31	4.11		0.09		2.34		5.39	16.51		0.85		0.77
Mean	2.90	4.82	1.98	1.46	2.77	4.29	1.74	4.71	3.66	0.39	2.55	2.37
Max	4.26	21.11	11.25	8.58	10.12	12.13	15.93	28.70	17.37	1.41	9.66	13.86
Min	0.02	1.54	0.09	0.08	1.06	1.14	0.03	0.00	0.09	0.00	0.36	0.77

Table 3-3b. 2004 daily mean discharges (cubic feet/second) for sites within the Swift Creek Reservoir Watershed. Bold values indicate estimated flow.

Westbranch

<u>Day</u>	<u>January</u>	<u>February</u>	<u>March</u>	<u>April</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>August</u>	<u>September</u>	<u>October</u>	<u>November</u>	<u>December</u>
1	2.01	2.03	1.14	1.02	0.60	0.54	0.50	2.56	44.69	1.66	0.63	3.66
2	2.03	1.67	1.09	2.15	0.62	0.40	0.31	8.17	8.81	1.34	0.63	5.55
3	2.05	1.59	1.04	1.76	1.51	0.20	0.18	39.66	3.65	1.12	0.62	3.67
4	2.05	7.20	1.01	1.67	8.27	0.12	0.09	59.20	2.11	1.01	0.66	2.88
5	2.05	6.62	0.88	1.36	3.24	2.11	0.35	9.15	1.43	0.87	3.56	2.27
6	2.05	5.11	0.77	0.95	2.24	1.33	11.95	6.72	1.23	0.76	3.04	1.97
7	2.05	28.30	1.01	0.70	1.82	0.72	2.56	4.64	1.34	0.56	1.71	1.82
8	1.97	30.44	1.21	0.67	1.32	0.56	8.16	2.57	1.46	0.42	1.29	3.02
9	1.73	10.43	1.91	0.70	1.04	0.43	4.83	1.78	15.08	0.23	1.09	2.52
10	1.93	6.10	1.26	0.69	0.73	0.30	0.92	1.31	21.11	0.22	0.87	4.38
11	1.76	4.80	1.09	0.60	0.53	2.78	0.19	0.99	5.87	0.22	0.80	25.84
12	1.37	3.88	0.88	0.62	0.35	3.62	0.02	2.80	2.91	0.22	0.80	10.38
13	1.54	3.38	0.79	7.41	0.28	5.72	0.24	6.27	1.82	0.22	9.41	5.73
14	1.63	3.05	0.70	13.80	0.20	1.21	0.16	5.76	1.28	0.60	13.90	3.91
15	1.49	2.70	0.61	10.30	0.14	0.69	0.14	33.70	0.69	0.23	5.36	2.85
16	1.47	2.57	0.63	6.64	0.05	1.71	0.01	16.59	39.66	0.25	3.34	2.25
17	1.25	2.30	12.17	3.76	0.04	10.37	0.00	12.13	10.05	0.25	2.59	1.93
18	1.10	2.13	7.09	2.67	0.11	5.17	0.00	5.27	15.72	0.23	2.13	1.86
19	3.18	2.19	4.01	2.10	0.13	2.21	1.84	3.50	24.50	0.22	1.86	1.76
20	3.12	2.01	3.00	1.65	0.11	1.47	0.21	2.75	8.57	0.30	1.71	1.74
21	2.10	1.88	2.07	1.48	0.08	1.00	0.07	1.92	3.82	0.74	1.60	1.57
22	1.72	1.78	1.81	1.36	0.03	0.61	0.01	3.87	2.31	0.58	1.53	1.29
23	1.83	1.60	1.36	1.10	0.63	0.41	0.03	3.77	1.66	0.57	1.54	1.31
24	1.78	1.49	1.11	1.03	0.44	0.29	0.19	2.30	1.27	0.33	2.51	2.04
25	1.68	1.52	0.98	1.07	0.32	0.10	0.06	1.53	1.03	0.71	3.31	2.09
26	1.56	1.48	0.92	0.85	0.23	0.14	0.98	1.13	0.83	0.65	6.03	1.68
27	2.15	1.40	0.86	0.82	0.72	6.86	1.86	0.87	0.71	0.58	3.94	1.50
28	1.95	1.35	0.87	1.26	1.86	1.54	5.82	0.72	0.92	0.55	2.85	1.33
29	1.73	1.19	0.92	0.89	1.44	1.02	16.46	0.58	2.33	0.52	13.82	1.17
30	2.08		0.83	0.70	0.93	0.73	8.03	0.50	2.28	0.51	5.23	1.18
31	2.61		0.77		0.55		4.98	65.73		0.54		1.21
Mean	1.90	4.90	1.77	2.39	0.99	1.81	2.29	9.95	7.64	0.56	3.28	3.43
Max	3.18	30.44	12.17	13.80	8.27	10.37	16.46	65.73	44.69	1.66	13.90	25.84
Min	1.10	1.19	0.61	0.60	0.03	0.10	0.00	0.50	0.69	0.22	0.62	1.17

Table 3-3c. 2004 daily mean discharges (cubic feet/second) for sites within the Swift Creek Reservoir Watershed. Bold values indicate estimated flow.

Horsepen Creek

<u>Day</u>	<u>January</u>	<u>February</u>	<u>March</u>	<u>April</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>August</u>	<u>September</u>	<u>October</u>	<u>November</u>	<u>December</u>
1	3.60	3.15	2.72	1.38	0.92	0.61	0.65	1.10	18.20	1.05	1.04	2.29
2	3.79	2.88	2.70	1.94	0.92	0.56	0.69	1.49	2.99	0.95	1.03	3.03
3	4.00	2.86	2.72	1.87	1.11	0.52	0.73	52.08	1.74	0.93	1.02	2.51
4	4.00	5.52	2.68	1.79	2.99	0.50	0.74	24.12	1.29	0.89	1.04	1.98
5	4.00	6.30	2.65	1.55	1.79	0.65	0.87	3.03	1.10	0.85	1.60	1.68
6	4.00	5.30	2.62	1.33	1.26	0.77	8.52	5.62	1.01	0.79	2.14	1.53
7	4.00	11.30	2.69	1.22	1.17	0.65	1.99	3.77	1.23	0.74	1.35	1.46
8	4.00	29.57	2.63	1.21	0.99	0.59	7.49	1.74	1.15	0.76	1.15	2.21
9	4.00	8.59	3.43	1.18	0.89	0.57	3.15	1.16	3.90	0.75	1.05	1.99
10	4.00	6.12	2.87	1.14	0.86	0.54	1.13	0.87	14.62	0.75	0.97	2.35
11	4.00	5.31	2.71	1.10	0.83	0.59	0.80	0.76	2.68	0.78	0.94	34.16
12	4.00	4.73	2.65	1.12	0.80	0.68	0.71	0.81	1.55	0.74	0.95	6.86
13	3.77	4.41	2.61	3.32	0.78	0.90	0.69	2.11	1.23	0.74	2.34	3.59
14	3.47	4.23	2.50	10.50	0.76	0.61	0.73	4.33	1.05	0.81	11.98	2.64
15	3.47	4.05	2.48	5.75	0.75	0.55	0.76	71.76	0.99	0.81	3.30	2.04
16	3.47	3.87	2.50	3.48	0.74	0.73	0.64	8.97	11.82	0.75	2.22	1.73
17	3.47	3.67	10.66	2.22	0.73	2.65	0.57	6.01	4.99	0.71	1.83	1.59
18	3.47	3.62	7.25	1.74	0.92	1.80	0.54	2.58	6.21	0.68	1.60	1.55
19	3.47	3.73	4.89	1.50	0.97	0.92	0.78	1.94	20.69	0.65	1.49	1.50
20	3.47	3.60	3.32	1.36	0.77	0.76	0.60	1.55	3.28	0.69	1.40	1.48
21	3.47	3.42	2.28	1.20	0.75	0.68	0.53	1.12	1.88	0.92	1.33	1.31
22	3.47	3.33	2.12	1.11	0.68	0.62	0.51	1.28	1.46	0.86	1.26	1.19
23	3.53	3.12	1.84	1.06	0.83	0.59	0.52	1.92	1.24	0.85	1.25	1.25
24	3.31	3.05	1.64	1.04	0.68	0.55	0.69	1.14	1.09	0.83	1.80	1.45
25	2.93	3.08	1.52	0.99	0.65	0.57	0.58	0.91	0.98	0.97	2.40	1.53
26	2.54	2.99	1.45	0.94	0.61	0.61	0.77	0.80	0.93	0.94	4.68	1.27
27	2.83	2.86	1.41	0.97	0.65	1.36	0.87	0.74	0.89	0.87	2.77	1.20
28	2.97	2.80	1.39	1.14	0.99	0.79	2.11	0.68	0.92	0.85	1.95	1.13
29	2.93	2.73	1.34	1.01	0.72	0.67	4.64	0.64	1.29	0.88	6.49	1.06
30	2.99		1.28	0.95	0.59	0.65	4.80	0.61	1.44	0.94	3.16	1.12
31	3.42		1.27		0.56		1.86	4.99		1.02		1.08
Mean	3.54	5.18	2.80	1.90	0.93	0.77	1.63	6.79	3.79	0.83	2.25	2.96
Max	4.00	29.57	10.66	10.50	2.99	2.65	8.52	71.76	20.69	1.05	11.98	34.16
Min	2.54	2.73	1.27	0.94	0.56	0.50	0.51	0.61	0.89	0.65	0.94	1.06

Table 3-3d. 2004 daily mean discharges (cubic feet/second) for sites within the Swift Creek Reservoir Watershed. Bold values indicate estimated flow.

Blackman Creek

<u>Day</u>	<u>January</u>	<u>February</u>	<u>March</u>	<u>April</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>August</u>	<u>September</u>	<u>October</u>	<u>November</u>	<u>December</u>
1	2.07	7.57	2.40	1.87	1.70	0.62	0.50	49.69	72.42	0.05	0.24	0.86
2	1.94	6.49	2.32	4.49	1.71	0.54	0.49	77.90	5.02	0.04	0.25	1.50
3	2.66	6.76	2.43	3.51	3.33	0.25	0.40	147.64	0.63	0.05	0.27	1.06
4	2.60	29.57	2.19	3.04	18.69	0.19	0.23	91.06	0.05	0.05	0.30	0.74
5	2.14	33.97	2.10	2.18	7.04	0.89	0.40	18.09	0.00	0.04	0.86	0.58
6	2.97	26.72	1.89	1.66	4.45	1.73	67.64	14.37	0.00	0.01	0.82	0.50
7	3.44	76.33	2.71	1.54	4.00	0.85	6.40	10.41	0.02	0.00	0.21	0.47
8	1.82	190.84	2.38	1.56	2.63	0.64	16.01	3.74	0.00	0.02	0.15	0.88
9	1.61	48.74	5.28	1.46	1.82	0.44	2.25	2.12	1.08	0.03	0.14	0.68
10	1.96	27.34	2.50	1.33	1.53	0.20	0.43	1.49	17.53	0.05	0.15	1.11
11	1.49	20.26	2.11	1.24	1.31	0.22	0.16	1.25	0.27	0.06	0.19	59.27
12	1.33	14.58	2.02	1.28	1.10	0.70	0.16	1.65	0.08	0.06	0.23	5.74
13	1.86	12.34	1.93	13.74	0.97	5.91	0.40	10.60	0.02	0.07	3.12	1.32
14	2.00	10.68	1.59	51.53	0.79	1.12	1.16	19.18	0.00	0.12	14.89	0.84
15	1.60	9.29	1.57	28.34	0.61	0.67	1.29	294.57	0.00	0.15	1.26	0.50
16	1.66	7.96	1.70	13.92	0.44	0.67	1.20	31.27	44.31	0.13	0.79	0.30
17	1.28	6.80	43.22	6.94	0.36	5.68	0.32	40.50	4.79	0.12	0.56	0.25
18	1.21	6.58	25.85	4.74	0.80	4.08	0.14	12.00	11.08	0.12	0.42	0.23
19	4.15	7.21	10.47	3.64	1.23	0.84	0.98	7.00	45.67	0.12	0.36	0.20
20	5.49	6.69	6.11	3.10	0.71	0.47	0.86	4.11	1.15	0.14	0.38	0.20
21	1.95	6.04	3.18	2.66	0.67	0.29	0.74	1.89	0.18	0.26	0.34	0.16
22	1.34	5.38	2.78	2.61	0.53	0.20	0.71	2.52	0.09	0.20	0.31	0.16
23	2.33	3.79	2.02	2.31	2.05	0.18	0.81	3.68	0.04	0.20	0.33	0.16
24	3.74	3.50	1.81	2.26	0.88	0.22	1.53	1.85	0.00	0.19	0.78	0.25
25	3.45	3.71	1.76	2.31	0.56	0.22	1.34	1.25	0.00	0.27	1.20	0.23
26	1.61	3.16	1.71	2.16	0.38	0.27	3.66	1.07	0.00	0.21	2.35	0.16
27	3.16	2.83	1.66	2.56	0.51	7.96	6.38	0.99	0.00	0.16	1.10	0.15
28	4.48	2.81	1.74	3.53	2.09	1.46	19.18	0.97	0.00	0.16	0.73	0.13
29	4.23	2.44	1.62	2.04	0.95	0.88	88.44	0.95	0.12	0.16	8.33	0.11
30	5.05		1.51	1.79	0.62	0.76	82.95	0.99	0.13	0.17	1.40	0.13
31	8.84		1.52		0.38		60.82	91.42		0.21		0.12
Mean	2.76	20.36	4.65	5.84	2.09	1.30	11.87	30.52	6.82	0.12	1.42	2.55
Max	8.84	190.84	43.22	51.53	18.69	7.96	88.44	294.57	72.42	0.27	14.89	59.27
Min	1.21	2.44	1.51	1.24	0.36	0.18	0.14	0.95	0.00	0.00	0.14	0.11

Table 3-3e. 2004 daily mean discharges (cubic feet/second) for sites within the Swift Creek Reservoir Watershed. Bold values indicate estimated flow.

Otterdale Branch

<u>Day</u>	<u>January</u>	<u>February</u>	<u>March</u>	<u>April</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>August</u>	<u>September</u>	<u>October</u>	<u>November</u>	<u>December</u>
1	4.42	2.80	1.71	1.92	1.17	0.85	0.74	1.45	24.77	2.04	1.35	3.76
2	4.29	2.57	1.72	2.79	1.23	0.85	0.45	2.57	6.01	1.97	1.32	4.99
3	4.68	2.45	1.73	2.60	1.57	0.77	0.29	30.83	4.05	1.98	1.27	3.97
4	4.72	6.95	1.69	2.54	3.87	0.63	0.43	22.37	3.41	1.95	1.18	3.22
5	4.40	8.34	1.44	1.94	1.66	0.92	0.71	4.46	3.08	1.93	3.02	2.83
6	5.38	7.01	1.37	1.52	1.35	0.91	2.19	6.21	3.04	1.45	3.75	2.59
7	6.20	10.50	1.45	1.42	1.30	0.81	0.95	4.61	3.34	1.19	2.01	2.45
8	4.58	14.89	1.45	1.43	1.09	0.74	3.45	2.26	3.69	1.21	1.64	3.75
9	4.18	7.60	2.42	1.41	0.98	0.72	3.09	1.80	14.71	1.61	1.39	3.21
10	4.31	5.60	1.78	1.34	0.98	0.65	1.26	1.52	21.51	1.34	1.15	4.24
11	3.99	4.80	1.69	1.26	0.94	0.63	1.11	1.55	5.31	1.21	1.06	37.03
12	3.65	4.47	1.63	1.30	0.92	0.79	1.08	1.75	3.57	1.21	1.00	10.35
13	4.19	4.47	1.58	4.89	0.92	0.92	1.18	2.90	3.01	1.21	4.40	5.45
14	4.61	4.26	1.49	11.24	0.92	0.75	1.58	5.08	2.80	1.47	11.55	4.00
15	3.46	3.88	1.44	8.64	0.90	0.72	1.56	51.77	2.46	1.36	3.55	3.06
16	3.21	3.49	1.48	5.42	0.87	0.92	1.27	14.87	22.66	1.77	2.56	2.65
17	2.84	3.14	13.15	2.94	0.84	1.63	1.14	10.74	6.78	1.65	2.07	2.50
18	2.70	2.97	9.24	2.17	0.85	1.70	1.10	4.49	14.20	1.46	1.89	2.50
19	4.58	3.06	4.82	1.89	0.85	1.13	1.71	3.60	22.90	1.40	1.78	2.36
20	5.25	2.99	3.84	1.74	0.85	1.05	0.99	3.27	5.61	1.42	1.67	2.33
21	4.25	2.86	2.62	1.62	0.85	0.98	0.92	2.12	4.13	2.02	1.60	2.10
22	3.24	2.76	2.46	1.48	0.85	0.95	0.90	2.92	3.60	1.96	1.63	1.93
23	2.48	2.47	2.16	1.32	0.85	0.91	0.92	3.58	3.13	1.98	1.75	1.93
24	2.35	2.35	2.09	1.27	0.85	0.87	1.10	2.38	2.87	1.98	2.44	2.17
25	2.21	2.38	2.03	1.25	0.85	0.85	0.95	2.20	2.71	1.96	3.27	2.22
26	1.60	2.15	1.97	1.22	0.85	0.85	1.16	1.46	2.58	1.54	8.01	1.92
27	1.86	1.88	1.96	1.29	0.85	0.85	1.24	1.26	2.47	1.24	4.06	1.84
28	1.94	1.85	1.95	1.56	0.85	0.85	5.16	1.17	2.61	1.38	3.03	1.92
29	1.94	1.77	1.89	1.14	0.85	0.85	7.69	1.15	3.27	1.29	10.04	1.99
30	2.19		1.85	1.12	0.85	0.84	8.16	1.11	2.68	1.32	4.57	2.08
31	3.12		1.81		0.85		2.25	13.44		1.36		2.35
Mean	3.64	4.37	2.58	2.46	1.08	0.90	1.83	6.80	6.90	1.58	3.00	4.18
Max	6.20	14.89	13.15	11.24	3.87	1.70	8.16	51.77	24.77	2.04	11.55	37.03
Min	1.60	1.77	1.37	1.12	0.84	0.63	0.29	1.11	2.46	1.19	1.00	1.84

Table 3-3f. 2004 daily mean discharges (cubic feet/second) for sites within the Swift Creek Reservoir Watershed. Bold values indicate estimated flow.

Swift Creek

Day	January	February	March	April	May	June	July	August	September	October	November	December
1	24.26	16.92	10.03	7.66	4.24	3.16	1.38	9.15	167.84	14.55	9.84	39.39
2	24.26	12.93	9.85	14.76	4.05	3.05	2.03	10.15	48.92	10.72	9.26	43.91
3	24.26	12.20	10.14	17.77	6.24	2.12	2.35	153.78	26.61	9.20	8.91	45.10
4	24.26	29.71	10.22	14.03	32.74	1.50	1.71	119.68	16.73	8.19	8.85	31.94
5	24.26	55.58	9.58	10.61	23.74	2.55	1.51	43.32	12.36	8.18	18.18	26.16
6	24.25	43.47	9.16	7.96	10.99	7.78	4.71	25.99	10.23	8.18	48.59	23.09
7	24.25	50.72	9.56	6.44	9.07	4.36	2.76	23.04	10.36	8.18	26.60	21.04
8	24.24	153.40	10.48	6.21	6.36	2.77	13.77	11.31	10.24	8.18	18.41	30.82
9	21.50	74.19	16.17	6.11	4.47	2.03	37.13	7.22	25.94	8.17	14.40	34.32
10	19.60	51.71	11.61	5.74	3.50	1.78	8.32	5.39	97.38	8.17	10.58	30.48
11	18.79	43.02	9.23	5.23	3.09	1.66	3.64	4.26	44.72	8.16	9.15	112.10
12	15.39	35.73	8.30	5.22	2.72	1.65	2.79	3.91	23.82	8.16	8.44	93.16
13	18.56	30.07	7.89	20.77	2.26	4.25	2.12	10.17	15.87	8.17	18.99	67.34
14	29.52	27.37	7.86	78.32	1.90	3.01	2.15	58.01	12.03	8.50	89.20	49.54
15	26.18	24.28	7.32	68.82	1.68	2.09	9.92	161.16	10.20	9.67	52.39	35.68
16	26.18	22.09	7.11	51.94	1.47	1.77	4.84	113.62	53.89	9.13	31.53	28.18
17	26.18	19.42	44.04	31.67	2.19	3.54	2.35	57.19	61.35	7.58	24.95	24.44
18	26.18	15.94	64.39	22.45	3.24	9.75	1.44	33.34	46.32	6.70	21.41	23.36
19	26.18	15.64	34.95	17.24	6.40	4.48	3.18	25.49	199.65	5.91	19.59	21.99
20	26.18	14.86	25.36	13.53	3.03	2.61	2.65	30.05	78.61	6.10	18.01	21.07
21	22.71	13.94	18.12	10.81	2.25	2.20	1.63	15.36	39.17	14.76	16.87	19.80
22	20.28	13.40	15.78	9.14	1.95	1.45	1.17	16.66	24.28	10.29	16.04	19.05
23	20.28	11.80	12.45	7.71	15.39	1.19	1.15	55.29	17.40	9.13	15.07	18.28
24	18.53	10.44	10.34	6.56	7.11	1.17	8.85	24.25	13.06	8.46	18.38	19.84
25	15.80	10.32	9.44	6.13	3.17	0.96	5.12	13.45	10.46	10.22	27.36	23.94
26	15.80	10.17	8.81	5.29	1.92	0.94	3.38	8.95	8.85	11.54	67.58	18.99
27	15.80	10.31	8.40	5.48	2.74	12.23	3.80	6.77	8.19	10.50	60.12	16.35
28	15.80	11.30	8.26	11.26	50.79	6.21	41.94	5.75	8.61	9.36	35.08	15.19
29	15.80	10.68	7.90	7.71	13.19	2.83	52.83	4.98	15.57	8.87	72.43	14.70
30	16.47		6.93	5.13	5.81	1.83	54.17	4.46	23.21	8.75	60.43	14.16
31	19.37		6.57		3.41		23.15	35.74		9.43		14.37
Mean	21.65	29.36	14.07	16.26	7.78	3.23	9.93	35.42	38.06	9.07	28.55	32.19
Max	29.52	153.40	64.39	78.32	50.79	12.23	54.17	161.16	199.65	14.76	89.20	112.10
Min	15.39	10.17	6.57	5.13	1.47	0.94	1.15	3.91	8.19	5.91	8.44	14.16

Table 3-3g. 2004 daily mean discharges (cubic feet/second) for sites within the Swift Creek Reservoir Watershed. Bold values indicate estimated flow.

Tomahawk Creek

<u>Day</u>	<u>January</u>	<u>February</u>	<u>March</u>	<u>April</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>August</u>	<u>September</u>	<u>October</u>	<u>November</u>	<u>December</u>
1	6.94	4.31	3.91	4.34	3.20	2.21	1.01	2.47	51.77	3.28	3.65	8.56
2	6.57	2.46	3.93	5.99	3.15	1.77	0.75	7.40	12.34	2.58	3.39	11.06
3	7.11	1.28	4.03	5.69	3.72	1.09	0.54	66.59	7.29	2.25	3.15	8.80
4	7.00	2.97	4.03	5.49	9.90	0.59	0.30	58.46	5.49	1.99	3.18	7.23
5	6.60	3.51	3.98	4.75	6.20	1.75	0.44	13.43	4.39	1.72	9.13	6.42
6	8.36	6.71	3.90	4.22	4.45	2.72	1.35	10.03	3.73	1.40	9.30	5.84
7	9.23	21.25	4.13	4.07	4.01	1.40	0.92	7.21	3.70	1.19	5.52	5.59
8	6.90	53.71	4.19	3.97	4.07	0.93	7.08	4.63	4.53	1.04	4.58	8.92
9	7.06	17.56	6.51	3.84	3.91	0.94	4.86	3.32	17.99	0.95	3.88	6.73
10	8.59	13.46	4.74	3.74	3.50	0.88	2.30	2.43	39.92	1.05	3.29	9.53
11	1.63	12.09	4.23	3.65	3.29	0.67	1.70	1.97	10.42	1.10	3.11	50.50
12	0.00	10.52	3.96	3.71	2.94	0.72	1.25	1.75	6.81	0.88	3.07	18.35
13	1.81	9.72	3.84	12.80	2.68	2.64	1.02	4.12	5.22	0.87	10.51	12.01
14	7.13	9.12	3.59	26.34	4.66	1.15	1.19	5.37	4.19	1.97	25.76	9.64
15	5.77	8.26	3.48	18.26	1.79	0.84	2.03	53.28	3.61	2.03	10.59	7.77
16	5.15	7.65	3.54	13.27	1.18	0.82	1.00	20.24	14.81	1.68	8.28	6.73
17	4.32	7.10	22.15	9.72	1.14	3.84	0.58	18.52	9.23	1.07	7.09	6.17
18	3.99	6.44	15.24	8.05	1.38	5.20	0.19	10.19	14.12	0.78	6.29	5.90
19	6.84	6.19	9.79	7.06	1.54	2.20	1.39	8.35	50.24	0.53	5.85	5.51
20	7.12	5.83	8.41	6.44	1.10	1.65	0.72	6.55	12.12	1.06	5.46	5.36
21	5.01	5.45	7.18	5.99	1.13	1.55	0.20	4.37	7.84	7.68	5.13	4.90
22	4.05	5.20	6.67	5.62	0.97	1.08	1.01	7.93	5.97	3.70	4.81	4.10
23	4.11	4.74	5.89	4.76	2.55	0.90	0.62	9.18	4.54	3.07	4.71	4.02
24	4.66	4.64	5.17	4.14	1.36	0.76	2.31	4.61	3.60	2.77	5.98	4.70
25	5.29	4.71	4.76	3.98	0.91	0.61	0.81	3.34	2.97	3.73	8.27	4.26
26	4.83	4.72	4.58	3.72	0.68	0.59	0.99	2.67	2.46	3.64	15.67	3.50
27	6.72	4.50	4.48	4.05	3.32	6.49	1.41	2.28	2.13	3.16	9.85	3.18
28	5.72	4.38	4.42	6.26	8.70	2.36	6.38	2.00	2.40	2.97	7.57	2.84
29	5.14	3.95	4.28	4.36	3.02	1.65	9.89	1.74	5.62	2.93	18.33	2.48
30	5.20		4.08	3.60	2.12	1.66	9.74	1.56	5.83	3.06	10.47	3.04
31	5.60		3.99		1.94		4.39	22.51		3.45		2.70
Mean	5.63	8.70	5.71	6.73	3.05	1.72	2.21	11.89	10.84	2.24	7.53	7.95
Max	9.23	53.71	22.15	26.34	9.90	6.49	9.89	66.59	51.77	7.68	25.76	50.50
Min	0.00	1.28	3.48	3.60	0.68	0.59	0.19	1.56	2.13	0.53	3.07	2.48

Table 3-3h. 2004 daily mean discharges (cubic feet/second) for sites within the Swift Creek Reservoir Watershed. Bold values indicate estimated flow.

Little Tomahawk Creek

<u>Day</u>	<u>January</u>	<u>February</u>	<u>March</u>	<u>April</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>August</u>	<u>September</u>	<u>October</u>	<u>November</u>	<u>December</u>
1	1.32	1.62	1.19	1.14	0.87	1.11	0.81	0.18	35.47	4.23	2.11	4.62
2	1.30	1.40	1.16	1.78	0.99	0.92	0.89	7.46	10.61	4.10	2.00	6.20
3	1.52	1.44	1.16	1.47	1.29	0.62	0.56	31.74	6.28	3.99	2.01	4.83
4	1.35	5.27	1.15	1.41	6.09	0.46	0.41	33.66	5.38	3.90	2.06	4.27
5	1.41	5.00	1.08	1.12	2.18	1.66	0.51	7.08	4.84	3.83	6.14	3.86
6	2.41	3.72	0.98	0.94	1.41	2.24	1.21	5.14	4.57	3.92	5.07	3.64
7	2.14	18.81	1.12	0.95	1.22	0.77	0.74	3.48	4.67	3.31	3.29	3.60
8	1.39	21.94	1.10	0.89	1.37	0.59	6.33	2.45	7.45	2.79	2.88	5.37
9	1.37	6.89	2.37	0.90	0.67	0.51	2.90	1.93	33.19	2.19	2.69	4.17
10	1.54	4.61	1.27	1.11	0.60	0.48	0.97	0.97	33.56	1.70	2.45	5.51
11	1.28	3.56	1.09	0.79	0.57	0.31	0.60	0.97	7.40	1.72	2.34	25.29
12	1.14	3.15	1.05	0.81	0.96	0.49	0.48	1.25	5.38	1.63	2.30	8.04
13	1.38	2.91	1.01	7.18	0.46	2.19	0.50	2.88	4.72	1.61	11.99	5.67
14	1.21	2.64	0.89	8.98	0.51	0.49	0.57	4.91	4.50	2.94	12.96	4.79
15	1.02	2.70	0.86	9.11	0.59	0.38	0.51	20.09	3.96	2.68	5.66	4.20
16	0.98	2.27	0.96	5.42	0.44	0.41	0.36	9.29	12.00	2.48	4.58	3.89
17	0.76	2.07	11.43	3.79	0.53	5.21	0.33	9.23	5.99	2.24	4.14	3.76
18	0.73	2.33	5.30	2.98	1.08	3.85	0.32	4.98	13.38	2.01	3.82	3.71
19	2.15	2.14	3.03	2.48	1.17	1.22	1.28	3.95	19.47	1.90	3.63	3.59
20	1.89	1.83	2.38	2.13	0.50	0.79	0.45	2.94	7.25	2.70	3.51	3.57
21	1.17	1.78	1.83	1.88	0.48	0.78	0.35	2.49	5.66	5.45	3.28	3.44
22	0.98	1.75	1.76	1.75	0.46	0.52	0.32	6.03	4.87	3.02	3.05	3.27
23	1.01	1.51	1.48	1.37	1.16	0.48	0.61	5.77	4.20	2.75	3.04	3.33
24	1.41	1.50	1.30	1.24	1.72	0.67	1.56	3.48	3.91	2.40	3.52	3.80
25	1.50	1.46	1.26	1.13	0.72	0.44	0.53	3.36	3.67	3.00	4.15	3.43
26	1.14	1.31	1.22	0.96	0.44	0.46	0.66	3.03	3.47	2.74	6.65	3.08
27	1.61	1.44	1.26	1.23	3.35	7.03	1.01	2.51	3.33	2.51	4.49	3.00
28	1.55	1.39	1.09	2.24	5.36	1.38	4.01	2.24	3.53	2.36	3.78	2.88
29	1.44	1.25	1.03	1.09	1.98	0.83	8.05	1.98	7.83	2.24	11.32	2.79
30	1.65		0.98	0.93	1.18	0.69	5.52	2.39	6.21	2.24	5.71	2.95
31	2.04		1.10		0.96		0.71	65.81		2.22		2.91
Mean	1.41	3.78	1.77	2.31	1.33	1.27	1.42	8.18	9.23	2.80	4.49	4.76
Max	2.41	21.94	11.43	9.11	6.09	7.03	8.05	65.81	35.47	5.45	12.96	25.29
Min	0.73	1.25	0.86	0.79	0.44	0.31	0.32	0.18	3.33	1.61	2.00	2.79

Table 3-3i. 2004 daily mean discharges (cubic feet/second) for sites within the Swift Creek Reservoir Watershed. Bold values indicate estimated flow.

Swift Creek Wetland Discharge

Day	January	February	March	April	May	June	July	August	September	October	November	December
1	2.21	4.98	0.15	1.86	0.84	0.80	0.24	3.77	198.71	2.93	0.51	8.98
2	2.21	4.31	0.16	5.14	1.01	1.15	0.29	4.02	30.72	1.93	0.48	10.77
3	2.21	4.41	1.05	10.04	1.15	0.79	0.09	216.15	9.47	1.38	0.43	12.14
4	2.21	9.94	0.89	9.11	8.47	0.44	0.02	176.98	1.45	1.03	0.50	8.19
5	2.21	24.29	0.51	7.83	3.82	1.54	0.04	28.99	0.71	0.88	2.36	6.15
6	2.21	17.09	0.56	6.04	0.81	6.22	0.72	15.37	0.42	0.64	11.11	4.92
7	2.21	17.26	1.14	2.90	0.81	2.93	0.35	15.21	0.66	0.50	2.80	3.94
8	2.21	56.45	0.87	1.75	0.60	1.12	4.64	7.21	0.93	0.36	1.32	6.06
9	2.33	16.55	2.68	2.01	0.61	0.32	31.08	4.38	8.81	0.36	0.88	7.96
10	2.27	17.13	1.29	1.79	0.73	0.27	4.40	2.53	102.37	0.34	0.67	5.61
11	2.15	12.75	0.63	1.02	0.90	0.24	0.82	0.53	13.48	0.28	0.59	123.42
12	2.24	9.19	0.42	1.04	0.67	0.35	0.31	0.38	4.38	0.20	0.53	59.92
13	2.45	7.34	0.58	3.94	0.66	1.68	0.30	1.37	1.40	0.25	2.34	19.87
14	2.41	7.25	0.48	19.76	0.53	0.78	0.28	32.54	0.58	0.41	59.84	12.82
15	2.39	5.25	1.26	17.06	0.73	0.33	0.35	188.03	0.22	0.75	15.55	8.05
16	4.96	4.79	0.45	13.30	0.33	0.40	0.36	153.80	32.91	0.65	6.25	5.77
17	4.96	4.18	28.47	12.85	0.63	3.08	0.24	33.69	29.60	0.36	4.00	4.56
18	4.96	3.54	47.11	11.72	3.70	3.76	0.20	17.53	12.90	0.27	3.22	4.34
19	4.96	2.61	14.75	9.06	4.28	0.93	0.28	9.80	138.69	0.22	2.70	3.95
20	4.53	3.43	11.83	2.91	2.83	0.28	1.41	19.52	43.09	0.28	2.42	3.86
21	3.14	3.36	11.22	3.68	1.56	0.30	0.81	7.69	5.86	1.88	2.29	3.45
22	3.07	3.25	10.71	3.81	0.81	0.26	0.06	6.38	2.47	1.43	2.11	1.68
23	3.93	1.24	9.63	3.18	9.35	0.14	0.03	37.29	1.22	1.16	2.01	1.65
24	4.19	0.71	7.63	2.08	9.62	0.09	0.26	10.20	0.36	0.72	2.61	1.65
25	3.84	0.36	5.18	1.64	2.22	0.16	0.32	3.80	0.15	1.16	5.27	1.65
26	1.61	0.46	2.85	0.64	1.11	0.08	0.41	2.38	0.04	1.69	24.17	1.65
27	3.70	0.24	2.87	0.81	0.97	5.67	0.44	2.01	0.06	1.32	20.64	1.65
28	4.73	0.12	2.41	2.06	42.68	1.94	22.38	1.87	0.66	0.84	8.15	1.65
29	4.24	0.11	2.03	1.32	13.72	0.65	29.89	1.52	2.93	0.58	28.38	1.65
30	5.49		1.71	1.01	6.26	0.30	38.05	1.22	4.90	0.46	18.70	
31			1.65		2.95		12.55	25.72		0.51		
Mean	3.21	8.37	5.59	5.38	4.04	1.23	4.89	33.29	21.67	0.83	7.76	11.65
Max	5.49	56.45	47.11	19.76	42.68	6.22	38.05	216.15	198.71	2.93	59.84	123.42
Min	1.61	0.11	0.15	0.64	0.33	0.08	0.02	0.38	0.04	0.20	0.43	1.65

Table 3-3j. 2004 daily mean discharges (cubic feet/second) for sites within the Swift Creek Reservoir Watershed. Bold values indicate estimated flow.

Chimney House Place Direct Runoff Site (Brandermill)

<u>Day</u>	January	February	March	April	May	June	July	August	September	October	November	December
1	0.03	0.02	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.03		
2	0.03	0.02	0.00	0.00	0.03	0.00	0.00	0.11	0.00	0.03		
3	0.04	0.02	0.00	0.00	0.03	0.00	0.00	1.80	0.00	0.04		
4	0.03	0.15	0.00	0.02	0.02	0.00	0.00	1.64	0.00	0.04		
5	0.03	0.09	0.01	0.01	0.00	0.05	0.00	0.06	0.01			Gaging halted due to damaged weir
6	0.07	0.06	0.01	0.01	0.00	0.01	0.01	0.00	0.01			
7	0.04	0.51	0.01	0.02	0.00	0.01	0.01	0.00	0.01			
8	0.03	0.37	0.02	0.02	0.00	0.00	0.01	0.00	0.01			
9	0.03	0.14	0.06	0.03	0.00	0.00	0.01	0.00	1.30			
10	0.04	0.10	0.02	0.02	0.00	0.00	0.01	0.00	0.68			
11	0.02	0.08	0.02	0.01	0.04	0.00	0.01	0.00	0.03			
12	0.02	0.07	0.02	0.00	0.10	0.00	0.01	0.00	0.00			
13	0.04	0.06	0.02	0.07	0.02	0.00	0.02	0.00	0.00			
14	0.05	0.05	0.01	0.05	0.00	0.00	0.09	0.01	0.00			
15	0.07	0.04	0.01	0.10	0.00	0.00	0.23	1.35	0.00			
16	0.06	0.03	0.02	0.04	0.00	0.00	0.00	0.15	0.29			
17	0.04	0.03	0.25	0.04	0.00	0.00	0.28	0.21	0.01			
18	0.04	0.02	0.06	0.06	0.00	0.00	0.00	0.00	0.04			
19	0.04	0.02	0.04	0.08	0.00	0.00	0.00	0.02	0.06			
20	0.04	0.01	0.07	0.07	0.00	0.00	0.00	0.00	0.00			
21	0.04	0.01	0.04	0.03	0.00	0.00	0.00	0.00	0.00			
22	0.04	0.01	0.06	0.02	0.00	0.00	0.00	0.00	0.01			
23	0.04	0.01	0.04	0.01	0.00	0.00	0.02	0.00	0.02			
24	0.03	0.00	0.03	0.01	0.00	0.00	0.02	0.00	0.03			
25	0.02	0.01	0.02	0.01	0.00	0.00	0.01	0.00	0.03			
26	0.01	0.00	0.03	0.01	0.00	0.00	0.03	0.00	0.03			
27	0.01	0.00	0.03	0.01	0.00	0.00	0.01	0.00	0.03			
28	0.02	0.00	0.03	0.03	0.00	0.00	0.04	0.00	0.04			
29	0.02	0.00	0.04	0.04	0.00	0.00	0.12	0.00	0.16			
30	0.03		0.00	0.05	0.00	0.00	0.03	0.00	0.02			
31	0.04		0.00		0.00		0.00	0.73				
Mean	0.03	0.07	0.03	0.03	0.01	0.00	0.03	0.20	0.10	0.03	#DIV/0!	#DIV/0!
Max	0.07	0.51	0.25	0.10	0.10	0.05	0.28	1.80	1.30	0.04	0.00	0.00
Min	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00

Table 3-3k. 2004 daily mean discharges (cubic feet/second) for sites within the Swift Creek Reservoir Watershed. Bold values indicate estimated flow.

Chestnut Bluff Terrace Direct Runoff Site (Woodlake)

<u>Day</u>	<u>January</u>	<u>February</u>	<u>March</u>	<u>April</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>August</u>	<u>September</u>	<u>October</u>	<u>November</u>	<u>December</u>
1	0.11	0.10	0.09	0.12	0.07	0.05	0.05	0.12	0.88	0.09	0.07	0.10
2	0.11	0.09	0.08	0.19	0.10	0.03	0.05	0.32	0.26	0.09	0.07	0.23
3	0.16	0.09	0.08	0.11	0.22	0.03	0.04	1.16	0.14	0.08	0.09	0.10
4	0.12	0.45	0.06	0.09	0.47	0.02	0.03	1.35	0.13	0.07	0.12	0.09
5	0.11	0.49	0.05	0.08	0.12	0.37	0.08	0.20	0.12	0.07	0.12	0.08
6	0.22	0.23	0.04	0.07	0.16	0.08	0.34	0.35	0.16	0.06	0.12	0.07
7	0.13	1.07	0.06	0.07	0.09	0.05	0.18	0.18	0.12	0.06	0.12	0.07
8	0.10	1.41	0.08	0.07	0.07	0.04	0.31	0.10	0.20	0.06	0.12	0.15
9	0.10	0.48	0.11	0.07	0.06	0.04	0.16	0.08	1.34	0.06	0.12	0.07
10	0.14	0.35	0.06	0.06	0.06	0.10	0.10	0.07	0.87	0.05	0.12	0.24
11	0.10	0.30	0.05	0.06	0.05	0.12	0.08	0.06	0.26	0.04	0.12	1.09
12	0.10	0.25	0.05	0.06	0.06	0.12	0.07	0.12	0.14	0.04	0.12	0.31
13	0.11	0.24	0.05	0.16	0.06	0.12	0.07	0.18	0.10	0.12	0.12	0.19
14	0.10	0.21	0.04	0.19	0.05	0.12	0.05	0.20	0.10	0.63	0.12	0.16
15	0.10	0.20	0.04	0.19	0.04	0.12	0.04	0.99	0.10	0.05	0.12	0.13
16	0.10	0.19	0.04	0.19	0.02	0.12	0.02	0.31	0.55	0.05	0.11	0.11
17	0.10	0.17	0.81	0.19	0.02	0.12	0.02	0.26	0.23	0.03	0.10	0.12
18	0.10	0.15	0.21	0.18	0.02	0.12	0.03	0.15	0.53	0.03	0.09	0.11
19	0.10	0.15	0.18	0.16	0.02	0.12	0.07	0.12	0.74	0.03	0.08	0.10
20	0.10	0.15	0.18	0.14	0.02	0.02	0.02	0.09	0.23	0.08	0.07	0.10
21	0.10	0.15	0.14	0.13	0.02	0.02	0.02	0.07	0.16	0.07	0.07	0.10
22	0.10	0.15	0.13	0.13	0.02	0.02	0.01	0.20	0.12	0.05	0.06	0.12
23	0.10	0.15	0.11	0.11	0.12	0.02	0.04	0.12	0.11	0.05	0.08	0.12
24	0.09	0.15	0.11	0.12	0.03	0.01	0.03	0.08	0.09	0.04	0.13	0.21
25	0.09	0.15	0.10	0.10	0.02	0.01	0.02	0.06	0.08	0.10	0.15	0.13
26	0.09	0.13	0.10	0.09	0.02	0.02	0.06	0.06	0.08	0.06	0.29	0.04
27	0.10	0.09	0.09	0.13	0.08	0.41	0.06	0.05	0.08	0.07	0.12	0.03
28	0.09	0.09	0.09	0.14	0.08	0.10	0.27	0.05	0.11	0.07	0.12	0.03
29	0.09	0.09	0.08	0.08	0.05	0.08	0.81	0.04	0.31	0.07	0.12	0.03
30	0.16		0.07	0.08	0.04	0.06	0.32	0.04	0.12	0.07	0.12	0.03
31	0.15		0.08		0.04		0.17	1.42		0.07		0.03
Mean	0.11	0.27	0.11	0.12	0.07	0.09	0.12	0.28	0.28	0.08	0.11	0.15
Max	0.22	1.41	0.81	0.19	0.47	0.41	0.81	1.42	1.34	0.63	0.29	1.09
Min	0.09	0.09	0.04	0.06	0.02	0.01	0.01	0.04	0.08	0.03	0.06	0.03

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Table 3-4. Drainage Area, Discharge, and Runoff Data for Direct Runoff Areas

Direct Runoff Area	Drainage Area	Total Annual	Runoff
	(sq. miles)	Discharge (Mft ³)	(Mft ³ /mi ²)
1	2.54	89.2	35.1
2	2.12	52.8	24.9
3	0.76	29.3	38.5
4	7.34	246.6	33.6
Total	12.76	417.9	32.7

Table 3-5. 2004 Rainfall Gain to Swift Creek Reservoir

Annual Mean Rainfall (inches)	55.23
Total Gain (feet)	4.60
Reservoir Area (2.54 sq. mi. = sq. feet)	70,811,136
Lake Gain (cubic feet/year)	325,888,584
Lake Gain (million cubic feet/year)	325.9

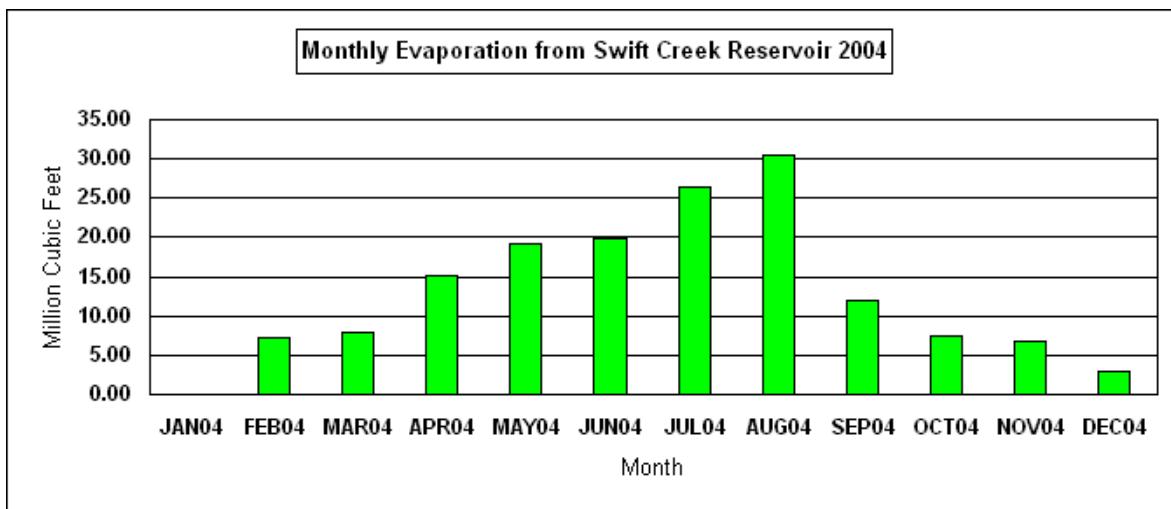


Table 3-6a. 2004 daily mean discharges (cubic feet/second) for sites within the Swift Creek Reservoir Watershed. Bold values indicate estimated flow.

Swift Creek Dam Spillway

<u>Day</u>	<u>January</u>	<u>February</u>	<u>March</u>	<u>April</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>August</u>	<u>September</u>	<u>October</u>	<u>November</u>	<u>December</u>
1	76.75	76.75	82.90	110.30	50.00	76.75	38.37	1,997.00	543.50	76.75	42.25	292.40
2	76.75	76.75	82.90	103.00	231.60	54.83	42.25	1,958.00	220.40	76.75	50.00	159.90
3	76.75	76.75	70.87	125.60	243.10	34.50	26.74	1,958.00	169.20	65.26	46.12	150.90
4	76.75	110.30	76.75	169.20	142.20	65.26	103.00	472.30	110.30	59.91	117.80	125.60
5	76.75	199.00	89.32	142.20	117.80	89.32	279.60	422.70	103.00	54.83	142.20	103.00
6	110.30	1,300.00	96.02	89.32	96.02	89.32	332.80	267.10	89.32	46.12	103.00	110.30
7	96.02	562.20	376.20	89.32	70.87	70.87	346.90	150.90	96.02	42.25	82.90	142.20
8	76.75	255.00	133.80	70.87	54.83	65.26	422.70	125.60	839.00	38.37	89.32	125.60
9	76.75	199.00	82.90	70.87	46.12	46.12	142.20	89.32	912.00	34.50	76.75	438.90
10	76.75	199.00	89.32	54.83	42.25	70.87	125.60	76.75	361.40	34.50	59.91	725.00
11	76.75	159.90	76.75	65.26	34.50	199.00	117.80	96.02	178.90	26.74	65.26	562.20
12	76.75	117.80	96.02	346.90	34.50	133.80	188.80	125.60	133.80	15.12	489.60	305.50
13	76.75	125.60	70.87	507.20	30.62	76.75	117.80	169.20	103.00	30.62	525.20	292.40
14	76.75	96.02	65.26	507.20	26.74	70.87	220.40	1,152.00	70.87	30.62	279.60	159.90
15	65.26	96.02	103.00	361.40	26.74	133.80	89.32	1,015.00	769.50	42.25	169.20	133.80
16	50.00	89.32	361.40	209.60	18.99	305.50	50.00	507.20	543.50	54.83	142.20	103.00
17	50.00	82.90	346.90	159.90	26.74	209.60	188.80	279.60	1,240.00	54.83	117.80	103.00
18	65.26	96.02	220.40	133.80	34.50	133.80	125.60	292.40	1,331.00	18.99	110.30	96.02
19	65.26	89.32	255.00	133.80	26.74	103.00	70.87	159.90	562.20	34.50	96.02	125.60
20	125.60	96.02	169.20	110.30	26.74	54.83	65.26	133.80	231.60	59.91	96.02	142.20
21	76.75	142.20	150.90	96.02	82.90	42.25	50.00	279.60	159.90	42.25	96.02	82.90
22	76.75	89.32	125.60	96.02	46.12	34.50	65.26	231.60	125.60	42.25	96.02	82.90
23	65.26	65.26	82.90	150.90	54.83	30.62	76.75	159.90	103.00	50.00	110.30	199.00
24	50.00	76.75	82.90	70.87	54.83	15.12	54.83	96.02	76.75	50.00	178.90	110.30
25	50.00	76.75	82.90	59.91	46.12	76.75	76.75	96.02	65.26	54.83	279.60	96.02
26	110.30	65.26	82.90	103.00	169.20	96.02	125.60	89.32	59.91	54.83	199.00	96.02
27	125.60	76.75	76.75	133.80	220.40	82.90	332.80	82.90	65.26	50.00	255.00	103.00
28	96.02	65.26	70.87	70.87	169.20	59.91	543.50	70.87	150.90	50.00	346.90	76.75
29	50.00	70.87	65.26	59.91	76.75	50.00	391.30	59.91	110.30	50.00	255.00	76.75
30	76.75		59.91	54.83	54.83	38.37	243.10	5,727.00	96.02	54.83	178.90	76.75
31	76.75		76.75		142.20		150.90	3,592.00		65.26		
Mean	77.51	166.62	125.92	148.57	80.61	87.02	167.92	707.53	320.71	47.16	163.24	179.93
Max	125.60	1300.00	376.20	507.20	243.10	305.50	543.50	5727.00	1331.00	76.75	525.20	725.00
Min	50.00	65.26	59.91	54.83	18.99	15.12	26.74	59.91	59.91	15.12	42.25	76.75

Table 3-6b. 2004 daily mean discharges (cubic feet/second) for sites within the Swift Creek Reservoir Watershed. Bold values indicate estimated flow.
Swift Creek Dam Spillway Seepage

Table 3-7. Monthly and Annual Evaporation Totals Determined at Swift Creek Reservoir.
Evaporation Measured by Hook Gage and Class A Evaporation Pan

Month	Average Reservoir Elevation	Reservoir Surface Area	Reservoir Surface Area	Pan Area	Monthly Total Evaporation	Monthly Total Evaporation	Monthly Total Evaporation	Monthly Total Evaporation (Adjusted by 0.74 coeff)
	Level Feet MSL	acres	square feet	square feet	inches	feet	million cubic feet	Million Cubic Feet
JAN04	177.2	1599	69,641,329	12.57	0.872	0.07	0.00	0.00
FEB04	177.3	1609	70,067,679	12.57	-1.681	-0.14	-9.82	-7.26
MAR04	177.3	1609	70,067,679	12.57	-1.830	-0.15	-10.69	-7.91
APR04	177.3	1609	70,067,679	12.57	-3.498	-0.29	-20.42	-15.11
MAY04	177.2	1599	69,641,329	12.57	-4.491	-0.37	-26.06	-19.29
JUN04	177.2	1599	69,641,329	12.57	-4.646	-0.39	-26.96	-19.95
JUL04	177.3	1609	70,067,679	12.57	-6.137	-0.51	-35.83	-26.52
AUG04	177.5	1628	70,920,381	12.57	-6.959	-0.58	-41.13	-30.43
SEP04	177.4	1618	70,494,030	12.57	-2.753	-0.23	-16.17	-11.97
OCT04	177.1	1589	69,214,978	12.57	-1.762	-0.15	-10.16	-7.52
NOV04	177.3	1609	70,067,679	12.57	-1.588	-0.13	-9.27	-6.86
DEC04	177.3	1609	70,067,679	12.57	-0.675	-0.06	-3.94	-2.92

Evaluation of the 2004 Water Budget

With near record rainfall in 2004, the inputs were correspondingly high (Table 3-8). Tropical Storm Gaston resulted in approximately 5 inches of rain over the reservoir watershed, significantly less than experienced in other watersheds in the Richmond Metro area, but still a substantial storm event.

The discharges from the wetlands adjacent to Swift Creek Reservoir have been estimated in the past at approximately 32 Mft³. In 2004, actual monitoring of the velocities and depths through the culverts at the wetlands indicated a flow of 284 Mft³. This represented a significant increase in inputs, greater than all other tributary inputs except for Swift Creek itself. The monitoring of the flow through the wetland pipes was a substantial improvement to the water budget.

Total output from the reservoir was significantly higher than inputs. Evaporation, plant withdrawals and golf course irrigation were within historical ranges. The discharge over the spillway dam was significantly higher than in most previous years, but similar to the 2003

discharge. The spillway stage-discharge curve developed by USGS was evaluated and determined to be reliable for the majority of flows during the year. For the extreme events, such as Tropical Storm Gaston, the USGS curve was expanded to include the upper range of discharge recorded for that storm. The estimate of discharge over the spillway appears to be a reliable measurement of flows into the reservoir. Unlike the tributary gage stations which are often affected by storm events and changing bed conditions, the spillway has a fixed stage-discharge relationship. Flows over the dam are relatively easy to monitor compared to the tributary stations.

The water budget indicates a large discrepancy between the estimated volumes flowing into the reservoir and those leaving the reservoir. This magnitude of the discrepancy in the past two years has been very large, equal to more than the total measured tributary inflow in each year. In 2003 and 2004, the discharge over the spillway was based on the reservoir water elevation, as measured by a pressure transducer. The transducer takes measurements every 15 minutes. The average daily stage to the hundredth of a foot was used to calculate discharge. For 2004, the discharge as calculated from the transducer was 5,980 Mft³.

In the previous years, the operators log was used to calculate discharge over the spillway. The operators log records stage once per day to the tenths of a foot. For comparison, the discharge for 2004 was also calculated based on the operator's log, and the result was 4201 Mft³, as substantial reduction in the estimate of spillway discharge.

The use of the transducer data instead of the operators log results in an increase in estimated flows of 1,779 Mft³. The transducer captures more of the storm event flows, particularly large flows such as Tropical Storm Gaston. In addition, since the transducer records to the hundredth of the foot, it records smaller, but important, fluctuations in discharge on a daily basis.

After factoring out the difference due to the change to using the transducer data, the water budget indicates an unaccounted for surplus of 2038 Mft³ leaving the reservoir. This discrepancy has been consistently observed in all but the driest years. This discrepancy is primarily the result of the following cumulative errors:

- Under estimation of inputs from groundwater
- Under estimation of storm flows at tributary stations
- Under estimation of flows from Direct Runoff Areas
- Errors associated with changes in the stage-discharge curves of the tributaries, especially those that are sand bed streams.

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Table 3-8. A Comparison of Water Budget Characteristic over the Past Eight Years

Inputs	1997 Mft ³	1998 Mft ³	1999 Mft ³	2000 Mft ³	2001 Mft ³	2002 Mft ³	2003 Mft ³	2004 Mft ³
Monitored Tributaries	986	1581	844	931	809	564	2654	1689
Direct Runoff Areas	225	483	274	279	244	148	557	418
Precipitation	218	284	280	241	179	210	369	326
Wetland Seepage	*	*	*	29	58	32	32	284
Groundwater Seepage	*	16	3	3	*	*	*	*
Total	1429	2364	1400	1481	1289	954	3612	2717
Outputs	Mft ³							
Evaporation	164	149	97	102	98	102	102	152
Plant Withdrawals	392	392	398	492	417	270	393	401
Golf Course Irrigation	3	3	2	2	3	2	2	1
Overflow	1454	2460	1075	1308	1053	234	5706	5980
Leakage	4	1	1	1	1	0	0	0
Flood Control Release	*	51	*	30	*	*	*	*
Total	2017	3056	1573	1934	1572	608	6203	6534
Change in Storage	-97	-205	306	-95	-191	291	0	0
Residual	-491	-487	-478	-359	-91	54	-2592	-3817

*Missing data points (Wetland Seepage not measured prior to 2000, Groundwater Seepage discontinued after 2000 and no Flood Control Releases occurred that year)

The discrepancy between the discharge at the spillway and what is estimated to enter the reservoir from the tributaries results in an underestimation of the phosphorous loading to the reservoir. If the tributary flows are under estimated, then the associated loadings of phosphorous have been under estimated.

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Appendix A: Tributary, Wetfall, & Dryfall Data by Date

CHESTERFIELD COUNTY UTILITIES DEPARTMENT		RESULTS OF 2004 BASEFLOW & STORMFLOW SURVEY WATER QUALITY ANALYSES (JANUARY - DECEMBER)																			
Y	DATE	TIME	TYPE	STORM#	DISSOLVED	D	FECAL	TOTAL	TOTAL KJELDAHL	OXIDIZED	TOTAL	ORTHOPHOSPHATE	TOTAL ORGANIC	TOTAL SUSPENDED	SOLIDS	TURBIDITY	LEAD	ZINC	REMARKS		
					TEMPERATURE	OXYGEN	OXYGEN	CONDUCTIVITY	COLIFORM	*	NITROGEN	NITROGEN	PHOSPHORUS	PHOSPHORUS	CARBON	(mg/L)	(ntu)	(mg/L)	(mg/L)		
					(Degrees Celsius)	% SATURATION	(mg/L)	(micro-mhos/cm)	(Colonies / 100 mL)	(mg/L as N)	(mg/L as N)	(mg/L as N)	(mg/L as P)	(mg/L as P)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			
1	01/12/04	12:10	Baseflow		2.1	90.4	12.53	6.33	34.6	10	0.22	< 0.01	0.02	0.005	3.61	< 2	8.72	< 0.0025	< 0.050		
2	01/12/04	12:25	Baseflow		1.8	93.0	12.99	6.12	38.9	57	0.27	0.26	0.01	0.04	< 0.005	3.26	2.0	3.52	< 0.0025	< 0.050	
3-I	01/12/04	13:50	Baseflow		1.2	87.8	12.47	5.86	18.4	7	0.23	0.22	0.01	0.03	< 0.005	4.40	< 2	4.10	< 0.0025	0.063	
3-II	01/12/04	13:05	Baseflow		0.7	91.3	13.21	6.11	21.6	3	0.25	0.23	0.02	0.03	0.005	4.48	2.4	8.19	< 0.0025	0.066	
4	01/12/04	14:00	Baseflow		2.5	97.5	13.27	5.93	20.1	6	0.21	0.20	0.01	0.02	< 0.005	3.92	< 2	4.66	< 0.0025	0.060	
5	01/12/04	15:30	Baseflow		1.4	81.9	11.57	6.38	30.3	24	0.31	0.31	< 0.01	0.04	0.011	3.25	3.6	7.84	< 0.0025	0.070	
6	01/12/04	15:40	Baseflow		3.2	91.6	12.34	6.14	22.8	16	0.27	0.27	< 0.01	0.02	0.005	2.81	< 2	6.99	< 0.0025	0.108	
7	01/12/04	15:50	Baseflow		3.0	98.8	13.36	6.36	37.8	4	0.19	0.19	< 0.01	0.02	< 0.005	1.61	< 2	6.43	< 0.0025	0.125	
8	01/12/04	11:45	Baseflow		4.2	93.2	12.24	6.28	22.6	17	0.47	0.47	< 0.01	0.04	0.006	3.99	< 2	7.42	< 0.0025	0.055	
13	01/12/04	16:00	Baseflow		7.2	84.3	10.23	6.24	62.1	152	0.19	0.19	< 0.01	0.04	< 0.005	2.30	2.4	12.2	< 0.0025	0.050	
14	01/12/04	12:45	Baseflow		7.3	102.3	12.38	6.54	49.4	10	0.17	0.17	< 0.01	0.04	0.017	1.45	< 2	1.72	< 0.0025	< 0.050	
1	02/09/04	9:40	Storm	1	2.2	98.0	13.55	6.19	40.2	37	0.49	0.43	0.06	0.06	0.012	8.14	103	91.4	0.0035	0.066	1.29 Inches Rain
2	02/09/04	10:00	Storm	1	2.9	95.0	12.88	5.94	53.1	201	0.68	0.53	0.15	0.07	0.020	9.90	108	24.2	0.0047	0.080	1.29 Inches Rain
3-I	02/09/04	11:30	Storm	1	2.2	95.3	13.19	5.69	16.9	28	0.45	0.44	0.01	0.04	0.011	11.1	100	49.2	0.0029	0.065	1.29 Inches Rain
3-II	02/09/04	10:50	Storm	1	2.3	96.0	13.28	6.00	23.6	44	0.38	0.37	0.01	0.04	0.011	10.8	277	112	0.0077	0.068	1.29 Inches Rain
4	02/09/04	12:05	Storm	1	2.7	97.3	13.28	5.85	20.9	36	0.37	0.33	0.04	0.05	0.010	7.88	21.7	16.7	< 0.0025	0.054	1.29 Inches Rain
5	02/09/04	12:30	Storm	1	0.9	92.8	13.28	6.51	28.8	33	0.46	0.41	0.05	0.04	0.011	4.46	25.7	17.9	0.0033	0.641	1.29 Inches Rain
6	02/09/04	13:15	Storm	1	2.7	99.1	13.53	6.24	25.9	13	0.49	0.30	0.19	0.05	0.010	6.50	178	83.2	0.0048	< 0.050	1.29 Inches Rain
7	02/09/04	13:30	Storm	1	3.1	99.0	13.34	6.42	19.7	15	0.66	0.44	0.22	0.07	0.020	4.68	274	246	0.0054	< 0.050	1.29 Inches Rain
8	02/09/04	9:20	Storm	1	4.4	99.7	13.06	6.08	27.0	12	0.54	0.54	< 0.01	0.08	0.016	5.42	16.0	20.6	< 0.0025	< 0.050	1.29 Inches Rain
13	02/09/04	15:00	Storm	1	3.6	93.4	12.43	6.05	41.0	345	1.03	0.72	0.31	0.08	0.009	5.05	36.3	28.3	< 0.0025	< 0.050	1.29 Inches Rain
14	02/09/04	10:15	Storm	1	5.7	98.3	12.41	6.43	60.3	285	0.96	0.49	0.47	0.08	0.009	8.00	140	72.8	0.0086	< 0.050	1.29 Inches Rain
1	02/17/04	9:10	Baseflow		2.4	94.8	13.19	6.27	33.8	19	0.27	0.22	0.05	0.02	0.007	3.15	< 2	10.3	0.0084	< 0.050	
2	02/17/04	9:30	Baseflow		2.0	95.1	13.36	5.95	40.5	31	0.42	0.26	0.16	0.04	< 0.005	3.00	< 2	3.54	< 0.0025	< 0.050	
3-I	02/17/04	10:30	Baseflow		1.8	94.5	13.75	5.79	17.3	167	0.26	0.25	0.01	0.02	0.005	3.82	< 2	3.30	< 0.0025	< 0.050	
3-II	02/17/04	9:55	Baseflow		2.5	98.5	13.71	5.98	21.7	16	0.26	0.24	0.02	0.03	0.006	4.24	< 2	5.42	< 0.0025	< 0.050	
4	02/17/04	10:15	Baseflow		1.7	94.5	13.45	5.69	19.9	26	0.27	0.20	0.07	0.03	0.005	3.34	3.4	3.31	< 0.0025	< 0.050	
5	02/17/04	11:05	Baseflow		1.6	92.2	13.13	6.49	29.4	46	0.44	0.33	0.11	0.03	0.011	2.99	2.2	9.68	< 0.0025	< 0.050	
6	02/17/04	11:15	Baseflow		1.8	96.0	13.61	6.13	23.9	5	0.45	0.24	0.21	0.03	0.007	2.10	15.6	8.70	< 0.0025	< 0.050	
7	02/17/04	11:45	Baseflow		2.7	98.6	13.60	6.34	12.2	23	0.36	0.15	0.21	0.02	0.015	2.19	5.2	42.8	< 0.0025	< 0.050	
8	02/17/04	9:00	Baseflow		5.0	94.6	12.29	6.26	23.0	2	0.57	0.49	0.08	0.04	0.009	3.82	< 2	14.0	< 0.0025	< 0.050	
13	02/17/																				

CHESTERFIELD COUNTY UTILITIES DEPARTMENT		RESULTS OF 2004 BASEFLOW & STORMFLOW SURVEY WATER QUALITY ANALYSES (JANUARY - DECEMBER)																			
Y	DATE	TIME	TYPE	STORM#	DISSOLVED		D	FECAL		TOTAL	TOTAL KJELDAHL	OXIDIZED	TOTAL	ORTHOPHOSPHATE	TOTAL ORGANIC	TOTAL SUSPENDED	SOLIDS	TURBIDITY	LEAD	ZINC	REMARKS
					TEMPERATURE	OXYGEN	OXYGEN	CONDUTIVITY	COLIFORM	* (mg/L as N)	(mg/L as N)	(mg/L as N)	(mg/L as P)	(mg/L as P)	(mg/L)	(mg/L)	(ntu)	(mg/L)	(mg/L)	(mg/L)	
3-II	04/05/04	13:00	Baseflow		8.2	84.7	9.96	6.44	49.4	19	0.29	< 0.01	0.03	0.007	5.26	< 2	4.02	< 0.0025	< 0.050		
4	04/05/04	12:30	Baseflow		10.0	95.8	10.81	6.12	42.9	41	0.29	0.26	0.03	0.006	5.05	< 2	3.42	< 0.0025	< 0.050		
5	04/05/04	11:55	Baseflow		9.0	106.4	12.28	6.95	69.1	75	0.37	< 0.01	0.03	0.014	8.81	2.2	6.72	< 0.0025	< 0.050		
6	04/05/04	11:42	Baseflow		9.4	124.8	13.98	6.64	51.8	38	0.41	0.36	0.05	0.015	5.21	< 2	4.64	< 0.0025	< 0.050		
7	04/05/04	11:21	Baseflow		8.2	123.6	14.49	6.85	80.0	19	0.51	0.34	0.17	0.03	0.006	2.15	< 2	7.25	< 0.0025	< 0.050	
8	04/05/04	14:30	Baseflow		12.7	60.3	6.40	7.14	50.8	20	0.61	0.61	< 0.01	0.03	0.007	4.46	2.8	6.80	< 0.0025	< 0.050	
13	04/05/04	10:45	Baseflow		10.7	124.0	13.72	6.45	139.9	63	0.37	0.23	0.14	0.03	0.006	7.81	< 2	4.20	< 0.0025	< 0.050	
14	04/05/04	13:15	Baseflow		13.2	85.6	8.89	6.78	99.0	78	0.66	0.23	0.43	0.03	0.005	10.3	< 2	1.01	< 0.0025	< 0.050	
1	04/27/04	11:05	Storm	3	17.7	81.8	7.77	6.67	115.9	214	0.68	0.64	0.04	0.03	0.007	7.94	7.5	12.6	< 0.0025	< 0.050	0.53 Inches Rain
3-II	04/27/04	11:45	Storm	3	17.2	89.0	8.53	6.44	57.4	411	0.57	0.57	< 0.01	0.03	**	13.3	76.0	37.2	< 0.0025	< 0.050	0.53 Inches Rain
5	04/27/04	12:10	Storm	3	17.0	78.1	7.51	6.69	83.9	146	0.58	0.53	0.05	0.03	0.015	8.81	40.5	25.4	< 0.0025	< 0.050	0.53 Inches Rain
6	04/27/04	12:20	Storm	3	16.7	86.0	8.32	6.53	60.1	365	0.70	0.62	0.08	0.02	0.007	7.14	49.0	27.3	< 0.0025	< 0.050	0.53 Inches Rain
7	04/27/04	12:30	Storm	3	17.2	89.6	8.59	6.64	73.2	517	0.69	0.49	0.20	0.05	0.007	6.97	26.5	34.6	< 0.0025	< 0.050	0.53 Inches Rain
1	05/04/04	11:45	Storm	4	17.0	81.1	7.84	6.50	94.9	2419	0.64	0.59	0.05	0.05	0.020	13.4	65.5	45.3	< 0.0025	< 0.050	1.38 Inches Rain
2	05/04/04	11:35	Storm	4	15.9	82.1	8.11	6.18	97.1	>2419	0.68	0.58	0.10	0.07	0.046	14.1	79.5	34.6	< 0.0025	< 0.050	1.38 Inches Rain
3-I	05/04/04	10:55	Storm	4	14.9	79.2	8.01	5.88	37.9	1300	0.57	0.57	< 0.01	0.03	0.015	18.2	63.5	19.7	< 0.0025	< 0.050	1.38 Inches Rain
3-II	05/04/04	11:00	Storm	4	14.8	83.7	8.48	6.12	46.4	2419	0.53	0.53	< 0.01	0.03	0.020	12.2	37.0	18.4	< 0.0025	< 0.050	1.38 Inches Rain
4	05/04/04	10:40	Storm	4	14.6	85.4	8.68	5.92	41.3	980	0.58	0.58	< 0.01	0.02	0.007	14.3	54.0	16.4	< 0.0025	< 0.050	1.38 Inches Rain
5	05/04/04	10:25	Storm	4	15.4	70.9	7.09	6.61	80.4	579	0.70	0.67	0.03	0.03	0.016	9.02	537	66.5	0.0058	< 0.050	1.38 Inches Rain
6	05/04/04	10:10	Storm	4	15.1	83.8	8.39	6.34	56.1	236	0.72	0.61	0.11	0.02	0.006	9.88	35.5	15.6	< 0.0025	< 0.050	1.38 Inches Rain
7	05/04/04	10:00	Storm	4	14.9	87.0	8.77	6.76	107	326	1.03	0.72	0.31	0.06	0.030	6.93	226	94.4	0.0058	< 0.050	1.38 Inches Rain
8	05/04/04	11:55	Storm	4	20.2	83.7	7.57	6.47	61.8	437	0.95	0.95	< 0.01	0.06	0.006	6.89	12.5	8.50	< 0.0025	< 0.050	1.38 Inches Rain
13	05/04/04	9:30	Storm	4	14.3	74.9	7.67	6.22	121	>2419	1.51	1.33	0.18	0.23	< 0.005	3.20	16.5	6.45	< 0.0025	< 0.050	1.38 Inches Rain
14	05/04/04	11:20	Storm	4	15.0	81.9	8.26	6.40	88.8	>2419	2.22	1.57	0.65	0.30	< 0.005	2.77	2.0	3.90	< 0.0025	< 0.050	1.38 Inches Rain
1	05/10/04	12:50	Baseflow		22.3	87.7	7.68	6.56	49.4	47	0.51	0.47	0.04	0.03	< 0.005	5.85	29	11.6	< 0.0025	< 0.050	
2	05/10/04	12:15	Baseflow		20.5	85.8	7.76	6.15	92.4	>2419	0.62	0.49	0.13	0.04	0.011	5.37	7.6	6.80	< 0.0025	< 0.050	
3-I	05/10/04	11:35	Baseflow		20.2	84.4	7.69	6.01	44.0	96	0.38	0.38	< 0.01	0.04	0.012	7.24	2.4	5.50	< 0.0025	< 0.050	
3-II	05/10/04	11:45	Baseflow		21.1	89.7	8.03	6.28	49.9	816	0.37	0.37	< 0.01	0.03	0.005	7.42	3.4	6.10	< 0.0025	< 0.050	
4	05/10/04	11:20	Baseflow		19.3	90.0	8.32	5.80	49.6	173	0.45	0.43	0.02	0.02	< 0.005	5.72	< 2	4.30	< 0.0025	< 0.050	
5	05/10/04	10:45	Baseflow		22.3	82.4	7.24	6.78	31.2	80	0.63	0.56	0.07	0.05	0.018	7.48	7.8	13.0	< 0.0025	< 0.050	
6	05/10/04	10:25	Baseflow		19.9	86.2	7.89	6.39	54.0	28	0.63	0.56	0.07	0.02	< 0.005	4.23	5.8	6.50	< 0.0025	< 0.050	
7	05/10/04	10:10	Baseflow		19.9	92.7	8.50	6.82	33.4	548	0.43	0.34	0.0								

CHESTERFIELD COUNTY UTILITIES DEPARTMENT																			
ADDISON-EVANS WATER PRODUCTION FACILITY																			
RESULTS OF 2004 BASEFLOW & STORMFLOW SURVEY WATER QUALITY ANALYSES (JANUARY - DECEMBER)																			
				DISSOLVED	D		FECAL	TOTAL	TOTAL KJELDAHL	OXIDIZED	TOTAL	ORTHOPHOSPHATE	TOTAL ORGANIC	TOTAL SUSPENDED					
				TEMPERATURE	OXYGEN	OXYGEN	CONDUCTIVITY	COLIFORM	*	NITROGEN	NITROGEN	PHOSPHORUS	PHOSPHORUS	CARBON	SOLIDS	TURBIDITY	LEAD	ZINC	
Y	DATE	TIME	TYPE	STORM#	(Degrees Celsius)	% SATURATION	(mg/L)	pH	(micro-mhos/cm)	(Colonies / 100 mL)	(mg/L as N)	(mg/L as N)	(mg/L as P)	(mg/L as P)	(mg/L)	(ntu)	(mg/L)	(mg/L)	REMARKS
1	07/12/04	10:35	Baseflow		24.1	78.8	6.62	6.51	101	548	0.49	0.43	0.06	0.01	0.005	7.05	25	15.6	< 0.0025 < 0.050
2	07/12/04	10:25	Baseflow		23.8	80.0	6.76	6.13	88.7	214	0.51	0.39	0.12	0.02	0.006	7.15	42	25.6	< 0.0025 < 0.050
3-I	07/12/04	9:45	Baseflow		22.5	78.6	6.82	5.78	43.1	153	0.34	0.34	< 0.01	0.01	< 0.005	9.46	6.0	8.90	< 0.0025 < 0.050
3-II	07/12/04	9:55	Baseflow		23.4	61.5	5.25	5.99	58.5	157	0.35	0.35	< 0.01	0.01	< 0.005	10.6	7.2	9.50	< 0.0025 < 0.050
4	07/12/04	9:35	Baseflow		22.6	78.2	6.78	5.62	52.9	121	0.28	0.28	< 0.01	0.01	0.005	7.97	< 2	9.15	< 0.0025 < 0.050
5	07/12/04	9:25	Baseflow		24.6	75.4	6.27	6.69	36.5	146	0.47	0.41	0.06	0.03	0.019	7.88	3.6	9.85	< 0.0025 < 0.050
6	07/12/04	9:05	Baseflow		23.6	78.3	6.66	6.43	74.2	51	0.39	0.32	0.07	< 0.01	< 0.005	10.7	8.2	16.0	< 0.0025 < 0.050
7	07/12/04	9:00	Baseflow		23.5	87.3	7.43	6.73	138	144	0.35	0.28	0.07	< 0.01	< 0.005	3.01	5.8	19.7	< 0.0025 < 0.050
8	07/12/04	10:40	Baseflow		28.7	102	7.95	7.12	45.9	70	0.63	< 0.01	0.02	< 0.005	8.18	6.4	10.9	< 0.0025 < 0.050	
13	07/12/04	8:42	Baseflow		22.6	68.9	5.95	6.27	134	248	0.71	0.56	0.15	< 0.01	< 0.005	3.10	3.0	8.34	< 0.0025 < 0.050
14	07/12/04	10:10	Baseflow		23.8	93.9	7.95	6.54	96.3	194	0.88	0.51	0.37	0.01	0.005	2.00	< 2	2.52	< 0.0025 < 0.050
1	07/29/04	13:15	Storm	6	22.8	79.6	6.88	6.52	96.4	387	0.79	0.66	0.13	0.11	0.036	16.1	85	99.4	< 0.0025 < 0.050 3.80 Inches Rain 6
2	07/29/04	13:30	Storm	6	22.4	83.2	7.24	6.25	97.7	1120	1.03	0.83	0.20	0.14	0.051	13.6	81	91.9	< 0.0025 < 0.050 3.80 Inches Rain 6
3-I	07/29/04	15:20	Storm	6	22.5	76.0	6.74	5.89	39.6	120	0.83	0.83	< 0.01	0.06	0.028	20.8	62	40.4	< 0.0025 < 0.050 3.80 Inches Rain 6
3-II	07/29/04	15:35	Storm	6	21.8	78.9	6.96	6.15	50.8	488	0.84	0.84	< 0.01	0.04	0.024	14.3	25	22.3	< 0.0025 < 0.050 3.80 Inches Rain 6
4	07/29/04	15:10	Storm	6	21.7	80.1	7.07	5.81	20.9	99	0.54	0.54	< 0.01	0.09	0.035	23.1	65	55.0	< 0.0025 < 0.050 3.80 Inches Rain 6
5	07/29/04	14:55	Storm	6	22.5	73.8	6.44	6.66	79.9	228	0.64	0.61	0.03	0.15	0.027	10.6	180	91.2	< 0.0025 < 0.050 3.80 Inches Rain 6
6	07/29/04	14:40	Storm	6	22.2	81.3	7.13	6.67	83.3	166	0.84	0.72	0.12	0.18	0.021	8.58	430	184	< 0.0025 < 0.050 3.80 Inches Rain 6
7	07/29/04	14:25	Storm	6	22.1	84.9	7.44	6.71	165	173	1.16	0.71	0.45	0.08	0.023	5.64	200	199	< 0.0025 < 0.050 3.80 Inches Rain 6
8	07/29/04	15:50	Storm	6	25.1	63.7	5.28	6.34	48.5	579	1.01	0.92	0.09	0.09	0.024	7.64	18	18.3	< 0.0025 < 0.050 3.80 Inches Rain 6
13	07/29/04	14:10	Storm	6	21.4	73.8	6.56	6.34	107	1046	2.06	1.42	0.64	0.03	0.023	5.26	6.0	11.1	< 0.0025 < 0.050 3.80 Inches Rain 6
14	07/29/04	13:45	Storm	6	22.4	83.6	7.28	6.42	77.3	>2419	2.93	1.78	1.15	0.37	0.044	8.30	240	115	< 0.0025 < 0.050 3.80 Inches Rain 6
1	08/17/04	15:20	Storm	7	21.7	88.2	7.83	5.95	46.2	517	0.87	0.84	0.03	0.06	0.022	12.6	49	48.9	< 0.0025 < 0.050 3.29 Inches Rain 7
2	08/17/04	13:00	Storm	7	20.7	89.7	8.11	5.64	51.8	816	1.06	0.97	0.09	0.11	0.027	11.6	130	93.1	< 0.0025 < 0.050 3.29 Inches Rain 7
3-I	08/17/04	15:00	Storm	7	21.0	87.2	7.83	4.98	22.8	307	0.51	0.51	< 0.01	0.05	0.011	18.6	130	62.1	< 0.0025 < 0.050 3.29 Inches Rain 7
3-II	08/17/04	15:10	Storm	7	21.4	91.0	8.13	5.18	26.5	231	0.52	0.52	< 0.01	0.04	0.010	14.0	70	43.2	< 0.0025 < 0.050 3.29 Inches Rain 7
4	08/17/04	14:55	Storm	7	21.1	91.2	8.19	5.32	29.7	285	0.53	0.53	< 0.01	0.02	0.008	13.6	17	12.7	< 0.0025 < 0.050 3.29 Inches Rain 7
5	08/17/04	14:15	Storm	7	21.3	77.6	6.94	6.02	45.7	147	0.56	0.53	0.03	0.06	0.019	9.97	24	26.6	< 0.0025 < 0.050 3.29 Inches Rain 7
6	08/17/04	14:00	Storm	7	21.4	89.6	7.98	5.88	46.7	727	0.74	0.61	0.13	0.23	0.019	9.05	540	226	< 0.0025 < 0.050 3.29 Inches Rain 7
7	08/17/04	13:45	Storm	7	21.6	91.7	8.15	6.22	78.0	687	0.86	0.72	0.14	0.06	0.022	4.67	150	129	< 0.0025 < 0.050 3.29 Inches Rain 7
8	08/17/04	15:30	Storm	7	24.2	79.0	6.70	5.89	36.4	727	0.88	0.86	0.02	0.07	0.016	11.1	24	32.0	< 0.0025 < 0.050 3.29 Inches Rain 7
13	08/17/04</																		

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RESULTS OF 2004 BASEFLOW & STORMFLOW SURVEY WATER QUALITY ANALYSES (JANUARY - DECEMBER)																					
				DISSOLVED	D		FECAL	TOTAL	TOTAL KJELDAHL	OXIDIZED	TOTAL	ORTHOPHOSPHATE	TOTAL ORGANIC	TOTAL SUSPENDED							
				TEMPERATURE	OXYGEN	OXYGEN	CONDUCTIVITY	COLIFORM	*	NITROGEN	NITROGEN	PHOSPHORUS	PHOSPHORUS	CARBON	SOLIDS	TURBIDITY	LEAD	ZINC			
Y	DATE	TIME	TYPE	STORM#	(Degrees Celsius)	% SATURATION	(mg/L)	pH	(micro-mhos/cm)	(Colonies / 100 mL)	(mg/L as N)	(mg/L as N)	(mg/L as P)	(mg/L)	(mg/L)	(ntu)	(mg/L)	(mg/L)	REMARKS		
3-II	09/10/04	11:15	Storm	9	23.5	91.0	7.68	5.20	23.2	488	0.66	< 0.01	0.07	0.017	21.6	120	70.3	< 0.025	< 0.050	2.46 Inches Rain 9	
4	09/10/04	10:55	Storm	9	22.9	92.8	7.93	5.23	23.0	517	0.56	0.54	0.02	0.09	0.018	22.2	170	76.0	< 0.025	< 0.050	2.46 Inches Rain 9
5	09/10/04	10:40	Storm	9	23.7	75.0	6.37	5.84	34.1	2419	0.80	0.78	0.02	0.07	0.024	12.2	27	25.3	< 0.025	< 0.050	2.46 Inches Rain 9
6	09/10/04	10:25	Storm	9	23.1	89.2	7.60	5.70	33.9	980	0.70	0.60	0.10	0.16	0.018	9.89	330	136	< 0.025	< 0.050	2.46 Inches Rain 9
7	09/10/04	10:10	Storm	9	23.4	92.5	7.85	5.99	44.2	727	0.78	0.67	0.11	0.09	0.048	7.48	420	382	< 0.025	< 0.050	2.46 Inches Rain 9
8	09/10/04	11:40	Storm	9	24.5	87.4	7.22	5.99	28.9	>2419	0.87	0.86	0.01	0.06	0.016	11.6	16	16.7	< 0.025	< 0.050	2.46 Inches Rain 9
13	09/10/04	9:50	Storm	9	23.2	83.2	7.07	5.88	88.1	1553	1.30	0.72	0.58	0.04	0.025	9.53	12	18.6	< 0.025	< 0.050	2.46 Inches Rain 9
14	09/10/04	9:35	Storm	9	23.5	89.5	7.56	5.93	87.1	2419	1.40	0.90	0.50	0.29	0.076	9.47	260	98.6	< 0.025	< 0.050	2.46 Inches Rain 9
1	09/14/04	13:00	Baseflow		21.0	77.0	7.00	6.44	71.6	326	0.53	0.49	0.04	0.02	0.006	7.24	4.8	9.00	< 0.025	< 0.050	
2	09/14/04	9:45	Baseflow		20.9	80.1	7.21	5.92	70.0	866	0.58	0.46	0.12	0.02	0.009	8.04	5.2	7.19	< 0.025	< 0.050	
3-I	09/14/04	12:30	Baseflow		20.7	85.1	7.72	6.12	11.6	199	0.44	0.44	< 0.01	0.02	0.005	10.4	4.2	5.50	< 0.025	< 0.050	
3-II	09/14/04	12:45	Baseflow		20.1	82.4	7.55	6.09	38.5	162	0.58	0.58	< 0.01	0.03	0.006	9.84	10	7.40	< 0.025	< 0.050	
4	09/14/04	12:15	Baseflow		20.3	83.4	7.62	5.73	37.4	99	0.61	0.59	0.02	0.02	0.006	9.50	6.7	8.01	< 0.025	< 0.050	
5	09/14/04	11:45	Baseflow		20.8	78.4	7.08	6.57	57.6	93	0.46	0.43	0.03	0.04	0.014	7.38	15	9.56	< 0.025	< 0.050	
6	09/14/04	11:15	Baseflow		20.5	87.3	7.95	6.17	47.4	186	0.50	0.39	0.11	0.02	0.007	5.12	6.0	12.6	< 0.025	< 0.050	
7	09/14/04	10:45	Baseflow		20.9	91.2	8.23	6.37	70.9	75	0.51	0.42	0.09	0.01	< 0.005	3.59	9.4	16.1	< 0.025	< 0.050	
8	09/14/04	13:30	Baseflow		24.0	86.8	7.38	6.17	33.2	27	0.53	< 0.01	0.04	0.007	10.0	10	10.7	< 0.025	< 0.050		
13	09/14/04	15:00	Baseflow		21.6	67.2	5.98	6.06	114	249	0.73	0.52	0.21	0.02	0.006	3.14	4.4	6.38	< 0.025	< 0.050	
14	09/14/04	10:15	Baseflow		21.2	85.8	7.69	6.20	89.7	142	1.15	0.51	0.64	0.01	0.007	2.20	< 2	2.65	< 0.025	< 0.050	
1	09/20/04	16:10	Storm	10	23.3	85.6	7.30	6.03	42.9	727	0.67	0.62	0.05	0.10	0.017	10.8	140	103	< 0.025	< 0.050	3.09 Inches Rain 10
2	09/20/04	14:05	Storm	10	22.8	87.0	7.45	5.81	21.0	485	0.80	0.68	0.12	0.20	0.017	9.46	300	171	< 0.025	< 0.050	3.09 Inches Rain 10
3-I	09/20/04	15:45	Storm	10	22.4	84.1	7.24	5.36	23.8	291	0.60	0.60	< 0.01	0.03	0.006	17.3	48	32.0	< 0.025	< 0.050	3.09 Inches Rain 10
3-II	09/20/04	16:00	Storm	10	23.3	87.9	7.49	5.63	26.6	489	0.59	0.59	< 0.01	0.05	0.007	17.3	120	63.6	< 0.025	< 0.050	3.09 Inches Rain 10
4	09/20/04	15:35	Storm	10	22.6	84.7	7.31	5.49	29.1	249	0.75	0.73	0.02	0.02	0.005	10.6	9.2	11.0	< 0.025	< 0.050	3.09 Inches Rain 10
5	09/20/04	15:00	Storm	10	23.3	80.1	6.86	6.27	18.5	159	0.69	0.65	0.04	0.06	0.013	7.78	67	31.4	< 0.025	< 0.050	3.09 Inches Rain 10
6	09/20/04	14:45	Storm	10	23.1	87.0	7.44	6.12	44.0	126	0.77	0.68	0.09	0.08	0.008	8.72	120	67.6	< 0.025	< 0.050	3.09 Inches Rain 10
7	09/20/04	14:30	Storm	10	23.7	89.7	7.54	6.39	70.4	155	0.75	0.59	0.16	0.04	0.008	5.48	46	78.4	< 0.025	< 0.050	3.09 Inches Rain 10
8	09/20/04	16:30	Storm	10	25.5	100	8.18	6.19	28.1	1987	0.91	0.89	0.02	0.07	0.011	10.8	31	29.8	< 0.025	< 0.050	3.09 Inches Rain 10
13	09/20/04	14:20	Storm	10	23.9	92.4	7.35	6.32	90.6	462	1.33	0.95	0.38	0.01	0.006	3.69	16	10.4	< 0.025	< 0.050	3.09 Inches Rain 10
14	09/20/04	14:15	Storm	10	23.9	80.7	6.82	5.81	43.4	1300	1.83	0.98	0.85	0.01	0.010	3.41	< 2	4.79	< 0.025	< 0.050	3.09 Inches Rain 10
3-I	10/04/04																				

CHESTERFIELD COUNTY UTILITIES DEPARTMENT		RESULTS OF 2004 BASEFLOW & STORMFLOW SURVEY WATER QUALITY ANALYSES (JANUARY - DECEMBER)																			
Y	DATE	TIME	TYPE	STORM#	DISSOLVED		D		FECAL		TOTAL	TOTAL KJELDAHL	OXIDIZED	TOTAL	ORTHOPHOSPHATE	TOTAL ORGANIC	TOTAL SUSPENDED				REMARKS
					TEMPERATURE (Degrees Celsius)	% SATURATION	OXYGEN (mg/L)	OXYGEN (mg/L)	CONDUCTIVITY (micro-mhos/cm)	COLIFORM (Colonies / 100 mL)	(mg/L as N)	NITROGEN (mg/L as N)	NITROGEN (mg/L as N)	PHOSPHORUS (mg/L as P)	PHOSPHORUS (mg/L as P)	CARBON (mg/L)	SOLIDS (mg/L)	TURBIDITY (ntu)	LEAD (mg/L)	ZINC (mg/L)	
6	12/06/04	14:00	Baseflow		9.5	95.4	11.00	6.47	47.4	24	0.30	0.14	0.16	0.01	< 0.005	3.00	3.6	9.28	< 0.0025	< 0.050	
7	12/06/04	13:35	Baseflow		10.3	96.9	11.00	6.79	68.1	179	0.25	0.12	0.13	0.01	< 0.005	2.16	3.4	9.80	< 0.0025	< 0.050	
8	12/06/04	15:35	Baseflow		9.6	90.2	10.40	6.64	43.1	122	0.24	0.22	0.02	< 0.005	5.67	5.6	8.56	< 0.0025	< 0.050		
13	12/06/04	13:15	Baseflow		12.4	78.8	8.47	6.42	116	99	0.12	< 0.05	0.12	0.01	< 0.005	2.38	< 2	8.13	< 0.0025	< 0.050	
14	12/06/04	12:45	Baseflow		12.2	95.5	10.30	6.68	90.5	93	0.68	0.15	0.53	<0.01	< 0.005	1.82	< 2	2.56	< 0.0025	< 0.050	
1	12/13/04	11:15	Storm	17	9.1	82.3	9.40	6.60	54.1	102	0.48	0.42	0.06	0.08	0.029	7.92	32	31.1	< 0.0025	< 0.050	1.40 Inches Rain 17
2	12/13/04	9:00	Storm	17	9.3	84.6	9.61	6.46	58.4	214	0.70	0.50	0.20	0.08	0.013	9.58	68	65.0	< 0.0025	< 0.050	1.40 Inches Rain 17
3-I	12/13/04	10:45	Storm	17	9.1	81.8	9.35	6.11	27.9	38	0.41	0.40	0.01	0.05	0.007	13.7	61	31.0	< 0.0025	< 0.050	1.40 Inches Rain 17
3-II	12/13/04	11:00	Storm	17	8.7	83.5	9.61	6.30	33.4	99	0.43	0.42	0.01	0.05	0.007	13.1	66	34.1	< 0.0025	< 0.050	1.40 Inches Rain 17
4	12/13/04	10:30	Storm	17	9.5	81.9	9.27	6.12	13.6	20	0.58	0.53	0.06	0.01	0.006	6.12	< 2	5.35	< 0.0025	< 0.050	1.40 Inches Rain 17
5	12/13/04	10:15	Storm	17	8.6	80.8	9.34	6.82	19.2	75	0.57	0.52	0.05	0.04	0.013	6.75	16	17.3	< 0.0025	< 0.050	1.40 Inches Rain 17
6	12/13/04	10:00	Storm	17	9.0	83.2	9.52	6.49	42.6	33	0.61	0.46	0.15	0.03	0.007	4.53	31	17.2	< 0.0025	< 0.050	1.40 Inches Rain 17
7	12/13/04	9:45	Storm	17	9.3	85.4	9.72	6.81	25.8	80	0.67	0.49	0.18	0.03	0.009	2.73	34	31.4	< 0.0025	< 0.050	1.40 Inches Rain 17
8	12/13/04	11:30	Storm	17	9.1	79.7	8.87	6.67	40.7	613	0.44	0.41	0.03	0.05	0.026	5.43	10	9.56	< 0.0025	< 0.050	1.40 Inches Rain 17
13	12/13/04	9:30	Storm	17	10.5	81.0	9.20	6.77	96.7	166	1.10	0.47	0.66	0.11	0.028	5.06	70	43.2	< 0.0025	< 0.050	1.40 Inches Rain 17
14	12/13/04	9:15	Storm	17	10.6	84.7	9.35	6.67	89.4	205	1.05	0.42	0.63	0.13	0.040	6.88	73	54.4	< 0.0025	< 0.050	1.40 Inches Rain 17

* Total nitrogen is calculated as the sum of total kjeldahl nitrogen and total oxidized nitrogen

** Data excluded due to analytical error.

*** Orthophosphate measured greater than total phosphorus, however within analytical methods error.

**CHESTERFIELD COUNTY UTILITIES DEPARTMENT
ADDISON-EVANS WATER PRODUCTION AND LABORATORY FACILITY**

SWIFT CREEK RESERVOIR WATERSHED ATMOSPHERIC NUTRIENT INPUTS (WETFALL)

PERIOD: January - December 2004

AREA OF BUCKET OPENING (m²)

0.0647

DATE	EVENT RAINFALL (Inches)	RAIN pH	RAINFALL VOLUME (LITERS)	TOTAL *		TOTAL KJELDAHL		TOTAL OXIDIZED		TOTAL PHOSPHORUS		ORTHO PHOSPHATE	
				NITROGEN		NITROGEN		NITROGEN		PHOSPHORUS		PHOSPHORUS	
				(mg/L as N)	(mg/m ²)	(mg/L as N)	(mg/m ²)	(mg/L as N)	(mg/m ²)	(mg/L as P)	(mg/m ²)	(mg/L as P)	(mg/m ²)
09-Feb-04	1.55	4.5	4.000	1.23	76.04	0.52	32.15	0.71	43.89	0.073	4.51	0.019	1.17
18-Mar-04	1.3	4.58	2.500	1.30	50.23	0.73	28.21	0.57	22.02	0.08	3.09	0.012	0.46
19-Apr-04	1.93	4.27	1.550			0.58	13.89	**	**			**	
04-May-04	1.29	5.2	2.400	0.88	32.64	0.44	16.32	0.44	16.32	0.032	1.19	0.022	0.82
01-Jun-04	1.92	5.47	2.200	2.26	76.85	1.8	61.21	0.46	15.64	**	**	0.198	6.73
08-Jun-04	1.12	4.55	1.950	0.95	28.63	0.68	20.49	0.27	8.14	0.0025	0.08	0.0025	0.08
14-Jun-04	1.67	4.12	2.300	0.95	33.77	0.64	22.75	0.31	11.02	0.008	0.28	0.0025	0.09
28-Jun-04	4.09	4.5	5.200	1.29	103.68	0.61	49.03	0.68	54.65	0.007	0.56	**	
12-Jul-04	3.18	4.4	4.000	0.54	33.38	0.33	20.40	0.21	12.98	0.0025	0.15	0.0025	0.15
29-Jul-04	6.57	5.92	7.800	0.75	90.42	0.37	44.61	0.38	45.81	0.192	23.15	0.103	12.42
06-Aug-04	5.33	4.9	7.700	0.52	61.89	0.4	47.60	0.12	14.28	**		**	
25-Aug-04	4.72	4.4	6.200	0.60	57.50	0.34	32.58	0.26	24.91	0.242	23.19	0.071	6.80
02-Sep-04	5.33	4.6	6.500	1.17	117.54	1.11	111.51	0.06	6.03	0.016	1.61	0.012	1.21
10-Sep-04	2.66	4.95	4.500	0.71	49.38	0.61	42.43	0.10	6.96	0.025	1.74	0.009	0.63
20-Sep-04	3.51	4.6	5.300	1.15	94.20	1.06	86.83	0.09	7.37	0.0025	0.20	0.0025	0.20
30-Sep-04	1.12	4.5	2.200	3.27	111.19	3.11	105.75	0.16	5.44	0.429	14.59	0.355	12.07
18-Oct-04	0.83	4.6	1.000	1.84	28.44	0.61	9.43	1.23	19.01	0.544	8.41	0.372	5.75
25-Oct-04	0.62	4.5	0.800	1.87	23.12	1.23	15.21	0.64	7.91	0.364	4.50	0.323	3.99
08-Nov-04	0.97	4.4	1.200	0.60	11.13	0.3	5.56	0.30	5.56	0.215	3.99	0.204	3.78
15-Nov-04	1.78	4.9	2.500	0.58	22.41	0.44	17.00	0.14	5.41	0.0025	0.10	0.0025	0.10
29-Nov-04	1.44	4.8	2.500	0.64	24.73	0.23	8.89	0.41	15.84	0.0025	0.10	0.0025	0.10
06-Dec-04	0.36	4.3	0.600	0.90	8.35	0.68	6.31	0.22	2.04	0.19	1.76	0.149	1.38
13-Dec-04	1.46	4.4	1.560	0.37	8.92	0.33	7.96	0.04	0.96	0.316	7.62	0.006	0.14

* TOTAL NITROGEN IS CALCULATED AS THE SUM OF TOTAL KJELDAHL NITROGEN AND TOTAL OXIDIZED NITROGEN

** DATA MISSING OR OMITTED DUE TO CONTAMINATION

Results less than Detection limit were included as 1/2 D.L.

**CHESTERFIELD COUNTY UTILITIES DEPARTMENT
ADDISON-EVANS WATER PRODUCTION AND LABORATORY FACILITY**

SWIFT CREEK RESERVOIR WATERSHED ATMOSPHERIC NUTRIENT INPUTS (DRYFALL)

PERIOD: January 2004 - December 2004

AREA OF BUCKET OPENING 0.0647

PERIOD OF DRYFALL (start)	DAYS (finish)	(-1 wet day)	BUCKET RINSE	TOTAL *		TOTAL KJELDAHL		TOTAL OXIDIZED		TOTAL PHOSPHORUS		ORTHO PHOSPHATE	
				NITROGEN		NITROGEN		NITROGEN		PHOSPHORUS		PHOSPHORUS	
				VOLUME (L)	(mg/L as N)	(mg/m ² /day)	(mg/L as N)	(mg/m ² /day)	(mg/L as N)	(mg/m ² /day)	(mg/L as P)	(mg/m ² /day)	(mg/L as P)
01-Jan-04	04-Mar-04	63	0.500	0.81	0.10	0.67	0.08	0.14	0.02	0.672	0.082	0.211	0.03
04-Mar-04	18-Mar-04	13	0.500	1.32	0.78	0.81	0.48	0.51	0.30	1.340	0.797	0.033	0.02
18-Mar-04	04-May-04	45	0.500	1.21	0.21	0.59	0.10	0.62	0.11	**	**	**	**
04-May-04	20-May-04	15	0.500	7.81	4.02	7.6	3.92	0.21	0.11	**	**	**	**
20-May-04	01-Jun-04	10	0.500	5.52	4.27	5.2	4.02	0.32	0.25	**	**	1.28	0.99
01-Jun-04	08-Jun-04	6	0.500	1.42	1.83	1.34	1.73	0.08	0.10	**	**	**	0.00
08-Jun-04	14-Jun-04	5	0.500	0.89	1.38	0.82	1.27	0.07	0.11	0.146	0.226	0.148	0.23
14-Jun-04	28-Jun-04	13	0.500	1.43	0.85	0.89	0.53	0.54	0.32	0.310	0.184	**	0.00
28-Jun-04	12-Jul-04	13	0.500	0.78	0.46	0.78	0.46	< 0.01	0.00	0.903	0.537	**	0.00
12-Jul-04	06-Aug-04	23	0.500	0.78	0.26	0.71	0.24	0.07	0.02	0.024	0.008	0.02	0.01
06-Aug-04	10-Sep-04	33	0.500	1.19	0.28	0.83	0.19	0.36	0.08	0.017	0.004	0.018	0.00
10-Sep-04	20-Sep-04	9	0.500	1.61	1.38	1.24	1.06	0.37	0.32	0.804	0.690	0.722	0.62
20-Sep-04	30-Sep-04	9	0.500	6.07	5.21	5.77	4.95	0.30	0.26	1.360	1.168	**	**
30-Sep-04	12-Oct-04	11	0.500	0.94	0.66	0.92	0.65	0.02	0.01	2.260	1.588	0.311	0.22
12-Oct-04	18-Oct-04	5	0.500	0.86	1.33	0.83	1.28	0.03	0.05	0.018	0.028	0.007	0.01
18-Oct-04	02-Nov-04	13	0.500	0.81	0.48	0.71	0.42	0.10	0.06	0.383	0.228	0.0025	0.00
02-Nov-04	15-Nov-04	12	0.500	0.35	0.23	0.30	0.19	0.05	0.03	0.007	0.005	0.0025	0.00
15-Nov-04	29-Nov-04	13	0.500	2.97	1.77	2.72	1.62	0.25	0.15	0.725	0.431	0.603	0.36
29-Nov-04	29-Dec-04	29	0.500	1.24	0.33	0.68	0.18	0.56	0.15	1.050	0.28	0.892	0.24

* Total nitrogen is calculated as the sum of total kjeldahl nitrogen and total oxidized nitrogen

** Data excluded due to analytical error.

Results less than Detection limit were included as 1/2 D.L.

**CHESTERFIELD COUNTY UTILITIES DEPARTMENT
ADDISON-EVANS WATER PRODUCTION AND LABORATORY FACILITY**

**ATMOSPHERIC NUTRIENT INPUTS OUTLIER ANALYSIS
PERIOD: January - December 2004**

WETFALL Concentrations		Total		
Event Date(s)	Phosphorus (mg/L as P)	T-Stat		
		High	Low	
08-Jun-04	0.0025	-0.809	0.809	
12-Jul-04	0.0025	-0.809	0.809	
20-Sep-04	0.0025	-0.809	0.809	
15-Nov-04	0.0025	-0.809	0.809	
29-Nov-04	0.0025	-0.809	0.809	
28-Jun-04	0.007	-0.782	0.782	
14-Jun-04	0.008	-0.776	0.776	
02-Sep-04	0.016	-0.728	0.728	
10-Sep-04	0.025	-0.674	0.674	
04-May-04	0.032	-0.632	0.632	
09-Feb-04	0.073	-0.386	0.386	
18-Mar-04	0.08	-0.344	0.344	
06-Dec-04	0.19	0.317	-0.317	
29-Jul-04	0.192	0.329	-0.329	
08-Nov-04	0.215	0.467	-0.467	
25-Aug-04	0.242	0.629	-0.629	
13-Dec-04	0.316	1.073	-1.073	
25-Oct-04	0.364	1.361	-1.361	
30-Sep-04	0.429	1.752	-1.752	
18-Oct-04	0.544	2.442	-2.442	

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DRYFALL Concentrations		Total		
Event Date(s)	Phosphorus (mg/L as P)	T-Stat		
		High	Low	
15-Nov-04	0.007	-1.021	1.021	
10-Sep-04	0.017	-1.005	1.005	
18-Oct-04	0.018	-1.004	1.004	
06-Aug-04	0.024	-0.995	0.995	
14-Jun-04	0.146	-0.806	0.806	
28-Jun-04	0.310	-0.553	0.553	
02-Nov-04	0.383	-0.440	0.440	
04-Mar-04	0.672	0.006	-0.006	
29-Nov-04	0.725	0.088	-0.088	
20-Sep-04	0.804	0.210	-0.210	
12-Jul-04	0.903	0.363	-0.363	
29-Dec-04	1.050	0.590	-0.590	
18-Mar-04	1.340	1.038	-1.038	
30-Sep-04	1.360	1.069	-1.069	
12-Oct-04	2.260	2.459	-2.459	

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WETFALL Loads		Total		
Event Date(s)	Phosphorus (mg/m ² /day)	T-Stat		
		High	Low	
08-Jun-04	0.08	-0.690	0.690	
15-Nov-04	0.10	-0.687	0.687	
29-Nov-04	0.10	-0.687	0.687	
12-Jul-04	0.15	-0.679	0.679	
20-Sep-04	0.20	-0.672	0.672	
14-Jun-04	0.28	-0.661	0.661	
28-Jun-04	0.56	-0.622	0.622	
04-May-04	1.19	-0.536	0.536	
02-Sep-04	1.61	-0.477	0.477	
10-Sep-04	1.74	-0.459	0.459	
06-Dec-04	1.76	-0.456	0.456	
18-Mar-04	3.09	-0.271	0.271	
08-Nov-04	3.99	-0.146	0.146	
25-Oct-04	4.50	-0.075	0.075	
09-Feb-04	4.51	-0.073	0.073	
13-Dec-04	7.62	0.358	-0.358	
18-Oct-04	8.41	0.468	-0.468	
30-Sep-04	14.59	1.327	-1.327	
29-Jul-04	23.15	2.516	-2.516	Outlier
25-Aug-04	23.19	2.522	-2.522	Outlier

MEAN
STANDARD
DEVIATION
n

DRYFALL Loads		Total		
Event Date(s)	Phosphorus (mg/m ² /day)	T-Stat		
		High	Low	
10-Sep-04	0.004	-0.880	0.880	
15-Nov-04	0.005	-0.879	0.879	
06-Aug-04	0.008	-0.871	0.871	
18-Oct-04	0.028	-0.829	0.829	
04-Mar-04	0.082	-0.713	0.713	
28-Jun-04	0.184	-0.496	0.496	
14-Jun-04	0.226	-0.408	0.408	
02-Nov-04	0.228	-0.403	0.403	
29-Dec-04	0.28	-0.292	0.292	
29-Nov-04	0.431	0.030	-0.030	
12-Jul-04	0.537	0.255	-0.255	
20-Sep-04	0.690	0.582	-0.582	
18-Mar-04	0.797	0.809	-0.809	
30-Sep-04	1.168	1.600	-1.600	
12-Oct-04	1.588	2.494	-2.494	

MEAN
STANDARD
DEVIATION
n

**CHESTERFIELD COUNTY UTILITIES DEPARTMENT
SWIFT CREEK WATER TREATMENT PLANT LABORATORY
PERIOD: JANUARY - DECEMBER 2004**

WETFALL Events Date(s)	TOTAL PHOSPHORUS		LEVEL Ft. M.S.L.	RESERVOIR SURFACE AREA		TOTAL PHOSPHORUS LOAD	
	(mg/L as P)	(mg/m ² as P)		Acres	m ²	(mg as P)	(LBS)
09-Feb-04	0.073	4.51	177.35	1613	6,529,305	29,467,652	64.98
18-Mar-04	0.08	3.09	177.37	1615	6,537,227	20,207,811	44.56
19-Apr-04	**						
04-May-04	0.032	1.19	177.29	1608	6,505,539	7,722,186	17.03
01-Jun-04	**	**					
08-Jun-04	0.0025	0.08	177.18	1597	6,461,969	486,895	1.07
14-Jun-04	0.008	0.28	177.19	1598	6,465,930	1,838,843	4.05
28-Jun-04	0.007	0.56	177.17	1596	6,458,008	3,633,254	8.01
12-Jul-04	0.0025	0.15	177.34	1612	6,525,344	1,008,554	2.22
06-Aug-04	**						
02-Sep-04	0.016	1.61	177.37	1615	6,537,227	10,508,062	23.17
10-Sep-04	0.025	1.74	177.48	1626	6,580,797	11,442,653	25.23
20-Sep-04	0.0025	0.20	177.38	1616	6,541,188	1,339,579	2.95
30-Sep-04	0.429	14.59	177.23	1602	6,481,774	94,551,750	208.49
18-Oct-04	0.544	8.41	177.07	1586	6,418,399	53,966,138	119.00
25-Oct-04	0.364	4.50	177.16	1595	6,454,047	29,048,201	64.05
08-Nov-04	0.215	3.99	177.22	1601	6,477,813	25,831,155	56.96
15-Nov-04	0.0025	0.10	177.32	1610	6,517,422	629,581	1.39
29-Nov-04	0.0025	0.10	177.40	1618	6,549,110	632,642	1.39
06-Dec-04	0.19	1.76	177.25	1604	6,489,696	11,434,704	25.21
13-Dec-04	0.316	7.62	177.43	1621	6,560,992	49,989,287	110.23
TOTAL						779.99	

CHESTERFIELD COUNTY UTILITIES DEPARTMENT
SWIFT CREEK WATER TREATMENT PLANT LABORATORY
 PERIOD: JANUARY - DECEMBER 2004

DRYFALL Events Date(s)	TOTAL PHOSPHORUS		LEVEL <u>Ft. M.S.L.</u>	RESERVOIR SURFACE AREA		TOTAL PHOSPHORUS LOAD	
	(mg/L as P)	(mg/m ² as P)		<u>Acres</u>	<u>m²</u>	(mg as P)	(LBS)
04-Mar-04	0.672	0.082	177.22	1601	6,477,813	533,977	1.18
18-Mar-04	1.340	0.797	177.32	1610	6,517,422	5,191,622	11.45
04-May-04	**	**					
20-May-04	**	**					
01-Jun-04	**	**					
08-Jun-04	**	**					
14-Jun-04	0.146	0.226	177.19	1598	6,465,930	1,459,082	3.22
28-Jun-04	0.310	0.184	177.17	1596	6,458,008	1,190,098	2.62
12-Jul-04	0.903	0.537	177.34	1612	6,525,344	3,502,785	7.72
06-Aug-04	0.024	0.008	177.41	1619	6,553,071	52,844	0.12
10-Sep-04	0.017	0.004	177.48	1626	6,580,797	26,199	0.06
20-Sep-04	0.804	0.690	177.38	1616	6,541,188	4,515,812	9.96
30-Sep-04	1.360	1.168	177.23	1602	6,481,774	7,569,305	16.69
12-Oct-04	2.260	1.588	177.06	1585	6,414,438	10,184,509	22.46
18-Oct-04	0.018	0.028	177.07	1586	6,418,399	178,564	0.39
02-Nov-04	0.383	0.228	177.15	1594	6,450,087	1,468,543	3.24
15-Nov-04	0.007	0.005	177.32	1610	6,517,422	29,380	0.06
29-Nov-04	0.725	0.431	177.40	1618	6,549,110	2,822,556	6.22
29-Dec-04	1.050	0.28	177.20	1599	6,469,891	1,810,314	3.99
TOTALS						89.38	

CHESTERFIELD COUNTY UTILITIES DEPARTMENT
SWIFT CREEK WATER TREATMENT PLANT LABORATORY
PERIOD: JANUARY - DECEMBER 2004

EVENT DATE(s)	TOTAL PHOSPHORUS LOAD (LBS)	Rain (inches)	n
WETFALL			
09-Feb-04	64.98	1.55	
18-Mar-04	44.56	1.3	
Winter	109.53	2.85	2
19-Apr-04	0.00	1.93	
04-May-04	17.03	1.29	
01-Jun-04	0.00	1.92	
08-Jun-04	1.07	1.12	
14-Jun-04	4.05	1.67	
28-Jun-04	8.01	4.09	
Spring	30.17	12.02	6
12-Jul-04	2.22	3.18	
06-Aug-04	0.00	5.33	
02-Sep-04	23.17	5.33	
10-Sep-04	25.23	2.66	
20-Sep-04	2.95	3.51	
30-Sep-04	208.49	1.12	
Summer	262.07	21.13	6
18-Oct-04	119.00	0.83	
25-Oct-04	64.05	0.62	
08-Nov-04	56.96	0.97	
15-Nov-04	1.39	1.78	
29-Nov-04	1.39	1.44	
06-Dec-04	25.21	0.36	
13-Dec-04	110.23	1.46	
Fall	378.23	7.46	7

**CHESTERFIELD COUNTY UTILITIES DEPARTMENT
SWIFT CREEK WATER TREATMENT PLANT LABORATORY
PERIOD: JANUARY - DECEMBER 2004**

Dryfall		TOTAL PHOSPHORUS LOAD		
PERIOD OF DRYFALL <u>(start)</u>	PERIOD OF DRYFALL <u>(finish)</u>	(LBS)	Dry Days	n
01-Jan-04	04-Mar-04	1.18	14	
04-Mar-04	18-Mar-04	11.45	45	
	Winter	12.62	59	2
08-Jun-04	14-Jun-04	3.22	13	
14-Jun-04	28-Jun-04	2.62	13	
	Spring	5.84	26	2
28-Jun-04	12-Jul-04	7.72	23	
12-Jul-04	06-Aug-04	0.12	33	
06-Aug-04	10-Sep-04	0.06	9	
10-Sep-04	20-Sep-04	9.96	9	
20-Sep-04	30-Sep-04	16.69	11	
	Summer	34.55	85	4
30-Sep-04	12-Oct-04	22.46	5	
12-Oct-04	18-Oct-04	0.39	13	
18-Oct-04	02-Nov-04	3.24	12	
02-Nov-04	15-Nov-04	0.06	13	
15-Nov-04	29-Nov-04	6.22	29	
29-Nov-04	29-Dec-04	3.99	1	
	Fall	36.37	73	6

Appendix B: Reservoir Water Quality Data by Date

CHESTERFIELD COUNTY UTILITIES DEPARTMENT		ADDISON-EVANS WATER PRODUCTION FACILITY		RESULTS OF 2004 RESERVOIR SURVEY WATER QUALITY ANALYSES (JANUARY - DECEMBER)																				
STATION	DATE	TIME	DEPTH	DISSOLVED		DISSOLVED		SECCHI	FECAL	TOTAL KJELDAHL	OXIDIZED	AMMONIA	TOTAL	ORTHOPHOSPHATE	TOTAL ORGANIC	TOTAL SUSPENDED	CARBON	SOLIDS	TURBIDITY	LEAD	ZINC			
				DEPTH	TEMPERATURE	OXYGEN	OXYGEN																	
				(Feet)	(Degrees Celsius)	(% SATURATION)	(mg/L)	pH	(Volts)	(micro-mhos/cm)	(Feet)	(Colonies/100mL)	(ppb)	(ppb)	(mg/L as N)	(mg/L as N)	(mg/L as N)	(mg/L as P)	(mg/L)	(mg/L)	(ntu)	(mg/L)		
4	01/13/04	10:42	Surface	0.1	3.9	92.4	12.15	6.30	0.709	19.3	3.0	816	1.9	< 0.1	0.40	0.39	0.01	0.04	0.020	0.011	6.13	3.6	11.1 < 0.0025	0.071
4	01/13/04	10:39	Mid-depth	3.0	3.9	91.8	12.10	6.31	0.702	19.3														
4	01/13/04	10:36	Mid-depth	6.0	3.9	90.7	11.97	6.33	0.700	19.3														
4	01/13/04	10:33	Mid-depth	9.0	3.8	90.2	11.88	6.37	0.697	19.5														
5	01/13/04	11:06	Surface	0.1	4.0	99.1	13.01	6.27	0.704	19.1	3.0	44	1.0	0.1	0.42	0.41	0.01	0.04	0.023	0.012	6.33	5.2	10.8 < 0.0025	0.051
5	01/13/04	11:03	Mid-depth	1.0	4.0	98.5	12.96	6.27	0.704	19.1														
5	01/13/04	11:00	Mid-depth	4.0	3.9	104.8	13.71	6.24	0.707	19.1														
5	01/13/04	10:57	Mid-depth	7.0	3.9	100.4	13.25	6.22	0.706	19.1							0.44	0.43	0.01	0.04	0.023	0.011		
5	01/13/04	10:54	Mid-depth	10.0	3.9	99.9	13.20	6.27	0.704	19.1														
5	01/13/04	10:51	Mid-depth	13.0	3.8	96.5	12.75	6.30	0.699	19.1														
5	01/13/04	10:48	Bottom	16.0	3.8	96.4	12.73	6.29	0.698	19.1							0.43	0.42	0.01	0.04	0.078	0.008		
6	01/13/04	11:33	Surface	0.1	4.3	96.3	12.71	6.31	0.667	19.3	2.5	46	2.7	0.1	0.41	0.40	0.01	0.03	0.024	0.010	6.51	3.6	10.9 < 0.0025	0.054
6	01/13/04	11:30	Mid-depth	1.0	4.3	95.9	12.69	6.31	0.665	19.3														
6	01/13/04	11:27	Mid-depth	4.0	4.2	95.6	12.46	6.28	0.663	19.3														
6	01/13/04	11:24	Mid-depth	7.0	4.2	93.5	12.38	6.27	0.660	19.3														
6	01/13/04	11:21	Mid-depth	10.0	4.2	88.1	11.52	6.32	0.665	19.3														
6	01/13/04	11:18	Mid-depth	13.0	4.2	87.9	11.48	6.30	0.655	19.3														
6	01/13/04	11:15	Mid-depth	16.0	4.2	87.6	11.46	6.31	0.654	19.3														
7	01/13/04	11:48	Surface	0.1	4.3	89.8	11.81	6.38	0.657	19.5	2.0	15	2.7	< 0.1	0.40	0.39	0.01	0.04	0.024	0.012	6.48	4.2	11.1 < 0.0025	0.050
7	01/13/04	11:45	Mid-depth	1.0	4.3	90.5	11.78	6.37	0.654	19.5														
7	01/13/04	11:42	Mid-depth	4.0	4.3	90.3	11.80	6.44	0.652	19.5														
7	01/13/04	11:39	Mid-depth	7.0	4.3	90.7	11.84	6.46	0.651	19.6														
7	01/13/04	11:36	Mid-depth	10.0	4.3	91.1	11.89	6.53	0.646	19.6														
8	01/13/04	12:16	Surface	0.1	5.1	86.2	11.08	6.22	0.673	19.0	3.0	12	4.1	0.1	0.50	0.49	0.01	0.04	0.025	0.011	6.67	3.2	11.8 < 0.0025	0.053
8	01/13/04	12:13	Mid-depth	2.0	5.0	86.1	11.05	6.21	0.672	19.0														
8	01/13/04	12:10	Mid-depth	5.0	5.0	86.7	11.13	6.20	0.670	19.1														
8	01/13/04	12:07	Mid-depth	8.0	5.0	86.8	11.14	6.24	0.665	19.1														
8	01/13/04	12:04	Mid-depth	11.0	5.0	86.5	11.12	6.22	0.665	19.1							0.50	0.49	0.01	0.04	0.025	0.011		
8	01/13/04	12:01	Mid-depth	14.0	5.0	86.7	11.11	6.24	0.664	19.2														
8	01/13/04	11:58	Mid-depth	17.0	5.0	87.4	11.21	6.26	0.664	19.1														
8	01/13/04	11:55	Mid-depth	20.0	5.0	89.3	11.44	6.34	0.655	19.0														
8	01/13/04	11:52	Bottom	23.0	5.0	88.8	11.41	6.36	0.654	19.1							0.48	0.48	< 0.01	0.04	0.027	0.010		
4	02/10/04	13:59	Surface	0.1	3.9	96.4	12.77	6.19	0.533	23.1	1.5	46	3.1	0.1	0.38	0.38	< 0.01	0.04	0.015	0.005	5.79	8.2	20 < 0.0025	< 0.05
4	02/10/04	13:56	Mid-depth	3.0	3.8	96.3	12.76	6.18	0.534	23.1														
4	02/10/04	13:53	Mid-depth	6.0	3.8	96.4	12.77	6.14	0.534	23.2														
4	02/10/04	13:55	Mid-depth	9.0	3.8	96.9	12.84	6.10	0.534	23.2														
5	02/10/04	14:28	Surface	0.1	4.1	100.5	13.22	6.36	0.528	22.5	2.5	33	6.4	0.1	0.38	0.38	< 0.01	0.04	0.013	0.007	5.74	< 2	13 < 0.0025	< 0.05
5	02/10/04	14:25	Mid-depth	1.0	4.1	100.4	13.21	6.35	0.527	22.5														
5	02/10/04	14:22	Mid-depth	4.0	4.0	98.5	12.99	6.34	0.527	22.5														
5	02/10/04	14:19	Mid-depth	7.0	4.0	98.8	13.04	6.33	0.524	22.5							0.39	0.39	< 0.01	0.04	0.013	0.005		
5	02/10/04	14:16	Mid-depth	10.0	3.9	99.1	13.09	6.31	0.523	22.6														
5	02/10/04	14:13	Mid-depth	13.0	3.9	99.0	13.08	6.29	0.522	22.7														
5	02/10/04	14:10	Bottom	16.0	3.9	98.8	13.04	6.29	0.520	22.9							0.39	0.39	< 0.01	0.04	0.012	0.006		
6	02/10/04	15:00	Surface	0.1	3.9	100.8	13.31	6.37	0.509	21.5	3.5	33	6.1	0.1	0.35	0.35	< 0.01	0.03	0.013	0.006	6.44	5	10.5 < 0.0025	< 0.05

* Total nitrogen is calculated as the sum of total kjeldahl nitrogen and total oxidized nitrogen.

CHESTERFIELD COUNTY UTILITIES DEPARTMENT																										
ADDISON-EVANS WATER PRODUCTION FACILITY																										
RESULTS OF 2004 RESERVOIR SURVEY WATER QUALITY ANALYSES (JANUARY - DECEMBER)																										
STATION	DATE	TIME	DEPTH	DEPTH	DISSOLVED	DISSOLVED	SECCI	FECAL	TOTAL KJELDAHL	OXIDIZED	AMMONIA	TOTAL	ORTHOPHOSPHATE	TOTAL ORGANIC	TOTAL SUSPENDED											
				(Feet)	TEMPERATURE	OXYGEN	OXYGEN	ORP	CONDUCTIVITY	DISK	COLIFORM	CHLOROPHYLL a	PHEOPHYTIN a	TOTAL NITROGEN	NITROGEN	NITROGEN	PHOSPHORUS	PHOSPHORUS	CARBON	SOLIDS	TURBIDITY	LEAD	ZINC			
					(Degrees Celsius)	(% SATURATION)	(mg/L)	pH	(Volts)	(micro-mhos/cm)	(Feet)	(Colonies/100mL)	(ppb)	(ppb)	(mg/L as N)	(mg/L as N)	(mg/L as N)	(mg/L as P)	(mg/L as P)	(mg/L)	(ntu)	(mg/L)	(mg/L)			
** Data excluded due to analytical error.																										
*** Orthophosphate measured greater than total phosphorus, however within analytical methods error.																										
8	02/23/04	11:01	Mid-depth	17.0	6.0	93.5	11.75	6.48	0.709	46.0																
8	02/23/04	10:58	Mid-depth	20.0	6.1	94.8	11.92	6.49	0.710	46.0																
8	02/23/04	10:55	Bottom	23.0	6.1	97.0	12.17	6.51	0.710	46.2																
1	03/09/04	11:54	Surface	0.1	12.4	88.7	9.50	6.69	0.744	59.0	2.5	12	5.3	0.2	0.42	0.42	< 0.01	0.04	0.023	< 0.005	4.64	7.67	8.62	< 0.0025	< 0.05	
1	03/09/04	11:51	Mid-depth	1.0	12.4	88.4	9.48	6.67	0.745	60.4																
1	03/09/04	11:48	Mid-depth	4.0	12.0	87.4	9.44	6.67	0.746	62.5																
1	03/09/04	11:45	Bottom	7.0	11.7	86.2	9.36	6.65	0.748	62.7																
2	03/09/04	12:06	Surface	0.1	12.7	92.1	9.76	6.78	0.719	51.3	3.0	10	5.8	0.1	0.44	0.44	< 0.01	0.04	0.018	< 0.005	4.65	7	6.93	< 0.0025	< 0.05	
2	03/09/04	12:03	Mid-depth	3.0	12.7	91.2	9.70	6.77	0.719	51.7																
2	03/09/04	12:00	Bottom	6.0	12.0	87.4	9.44	6.76	0.720	56.6																
3	03/09/04	12:39	Surface	0.1	12.0	92.0	10.07	6.80	0.650	64.6	2.0	22	8.7	0.1	0.45	0.43	0.02	0.04	0.016	< 0.005	4.45	13.3	13.9	< 0.0025	< 0.05	
3	03/09/04	12:36	Mid-depth	1.0	12.0	91.7	10.05	6.81	0.690	64.7																
3	03/09/04	12:33	Mid-depth	4.0	11.4	91.5	10.03	6.84	0.689	66.9																
3	03/09/04	12:30	Mid-depth	7.0	11.4	90.8	9.96	6.88	0.689	66.7																
3	03/09/04	12:27	Bottom	10.0	11.4	90.5	9.92	6.88	0.690	66.5																
4	03/09/04	12:24	Surface	0.1	11.9	96.8	10.49	6.73	0.705	48.6	3.3	58	4.7	0.1	0.53	0.50	0.03	0.04	0.022	< 0.005	5.07	5.67	7.52	< 0.0025	< 0.05	
4	03/09/04	12:21	Mid-depth	2.0	11.9	94.3	10.31	6.71	0.705	48.7																
4	03/09/04	12:18	Mid-depth	5.0	11.6	93.8	10.24	6.70	0.704	48.7																
4	03/09/04	12:15	Bottom	8.0	11.2	92.2	10.15	6.67	0.704	49.7																
5	03/09/04	13:03	Surface	0.1	11.9	100.0	10.83	6.71	0.683	48.5	3.3	91	7.7	0.1	0.50	0.47	0.03	0.04	0.017	< 0.005	5.16	6.67	8.59	< 0.0025	< 0.05	
5	03/09/04	12:54	Mid-depth	4.0	11.7	99.3	10.81	6.65	0.686	48.6																
5	03/09/04	12:51	Mid-depth	7.0	11.5	97.7	10.66	6.58	0.686	48.6																
5	03/09/04	12:48	Mid-depth	10.0	11.3	97.0	10.64	6.54	0.688	48.8																
5	03/09/04	12:45	Mid-depth	13.0	11.2	94.7	10.44	6.50	0.689	49.0																
5	03/09/04	12:42	Bottom	16.0	11.2	94.6	10.41	6.50	0.690	49.1																
6	03/09/04	13:28	Surface	0.1	12.1	103.4	11.11	6.78	0.645	49.4	3.3	13	7.5	0.1	0.49	0.46	0.03	0.04	0.016	< 0.005	5.21	6	7.98	< 0.0025	< 0.05	
6	03/09/04	13:25	Mid-depth	1.0	12.0	103.4	11.10	6.77	0.646	49.5																
6	03/09/04	13:22	Mid-depth	4.0	11.7	100.9	10.97	6.74	0.646	49.5																
6	03/09/04	13:19	Mid-depth	7.0	11.6	99.5	10.86	6.69	0.648	49.5																
6	03/09/04	13:16	Mid-depth	10.0	11.3	96.9	10.62	6.64	0.649	49.5																
6	03/09/04	13:13	Mid-depth	13.0	10.8	92.1	10.15	6.63	0.650	49.9																
6	03/09/04	13:10	Bottom	16.0	10.8	90.8	10.08	6.61	0.670	52.3																
7	03/09/04	13:44	Surface	0.1	11.9</																					

CHESTERFIELD COUNTY UTILITIES DEPARTMENT		ADDISON-EVANS WATER PRODUCTION FACILITY		RESULTS OF 2004 RESERVOIR SURVEY WATER QUALITY ANALYSES (JANUARY - DECEMBER)																					
STATION	DATE	TIME	DEPTH	DISSOLVED		DISSOLVED		SECCHI	FECAL		TOTAL KJELDAHL	OXIDIZED	AMMONIA	TOTAL	ORTHOPHOSPHATE	TOTAL ORGANIC	TOTAL SUSPENDED	TURBIDITY	LEAD	ZINC					
				DEPTH	TEMPERATURE	OXYGEN	OXYGEN		ORP	CONDUCTIVITY	DISK	COLIFORM	CHLOROPHYLL a	PHEOPHYTIN a	TOTAL NITROGEN	NITROGEN	NITROGEN	PHOSPHORUS	PHOSPHORUS	CARBON	SOLIDS	(mg/L)	(ntu)	(mg/L)	(mg/L)
8	06/01/04	13:05	Bottom	22.0	17.1	1.6	< 0.20	6.81	0.470	64.9					0.60	0.60	< 0.01	0.09	0.011	0.005					
5	06/14/04	10:06	Surface	0.1	25.4	88.4	7.34	6.62	0.565	56.0	3.5		6.8	0.1	0.52	0.52	< 0.01	0.03	0.020	< 0.005	5.27	3	4.54	< 0.0025	< 0.05
5	06/14/04	10:03	Mid-depth	1.0	25.4	87.5	7.21	6.61	0.565	55.9															
5	06/14/04	10:00	Mid-depth	4.0	25.2	84.8	6.99	6.58	0.563	55.7															
* Total nitrogen is calculated as the sum of total kjeldahl nitrogen and total oxidized nitrogen																									
** Data excluded due to analytical error.																									
*** Orthophosphate measured greater than total phosphorus, however within analytical methods error.																									
5	06/14/04	9:57	Mid-depth	7.0	25.1	83.4	6.90	6.54	0.563	56.3															
5	06/14/04	9:54	Mid-depth	10.0	24.9	74.1	6.16	6.31	0.563	56.9						0.53	0.53	< 0.01	0.05	0.024	< 0.005				
5	06/14/04	9:51	Mid-depth	13.0	23.0	29.7	2.56	6.01	0.564	59.1															
5	06/14/04	9:48	Bottom	16.0	22.1	12.7	1.11	6.07	0.564	66.4						0.60	0.58	0.02	0.06	0.031	< 0.005				
8	06/14/04	10:39	Surface	0.1	25.1	90.3	7.52	6.82	0.471	55.4	3.5		12.3	0.2	0.53	0.53	< 0.01	0.03	0.017	< 0.005	5.21	3	4.46	< 0.0025	< 0.05
8	06/14/04	10:36	Mid-depth	2.0	25.0	90.1	7.50	6.80	0.460	55.4															
8	06/14/04	10:33	Mid-depth	5.0	24.9	88.0	7.29	6.74	0.456	55.4															
8	06/14/04	10:30	Mid-depth	8.0	24.7	82.0	6.84	6.51	0.442	55.6															
8	06/14/04	10:27	Mid-depth	11.0	23.7	45.5	3.90	6.19	0.401	56.6						0.56	0.54	0.02	< 0.03	0.013	< 0.005				
8	06/14/04	10:24	Mid-depth	14.0	22.7	29.5	2.55	6.19	0.342	57.0															
8	06/14/04	10:21	Mid-depth	17.0	20.0	1.0	< 0.20	6.57	0.196	75.3															
8	06/14/04	10:18	Mid-depth	20.0	15.5	0.7	< 0.20	7.01	0.176	112.0															
8	06/14/04	10:15	Bottom	23.0	15.4	0.5	< 0.20	7.10	0.163	123.0						0.55	0.55	< 0.01	0.11	0.029	< 0.005				
1	06/28/04	12:19	Surface	0.1	25.8	77.9	6.32	6.48	0.717	62.6	1.5	20	31.2	0.7	0.54	0.54	< 0.01	< 0.03	0.052	< 0.005	7.63	10	11	< 0.0025	< 0.05
1	06/28/04	12:16	Mid-depth	2.0	25.6	77.0	6.31	6.48	0.719	62.8															
1	06/28/04	12:13	Mid-depth	5.0	24.1	30.5	2.60	6.18	0.733	70.6															
1	06/28/04	12:10	Bottom	8.0	23.8	22.9	1.94	6.26	0.734	71.4															
2	06/28/04	12:31	Surface	0.1	27.1	94.5	7.54	6.73	0.713	58.6	1.8	17	11.9	0.3	0.58	0.58	< 0.01	< 0.03	0.027	< 0.005	7.28	7.7	9.04	< 0.0025	< 0.05
2	06/28/04	12:28	Mid-depth	3.0	26.1	60.0	4.88	6.33	0.724	59.9															
2	06/28/04	12:25	Bottom	6.0	25.3	44.1	3.67	6.30	0.728	65.7															
3	06/28/04	13:07	Surface	0.1	26.5	90.7	7.58	6.81	0.711	72.0	1.4	40	12.6	0.3	0.52	0.52	< 0.01	< 0.03	0.020	< 0.005	5.55	17	20.2	< 0.0025	< 0.05
3	06/28/04	13:04	Mid-depth	1.0	26.5	86.1	6.84	6.56	0.715	71.7															
3	06/28/04	13:01	Mid-depth	4.0	25.2	72.6	6.00	6.54	0.723	76.2															
3	06/28/04	12:58	Mid-depth	7.0	25.2	69.1	5.71	6.50	0.724	77.5															
3	06/28/04	12:55	Bottom	10.0	25.1	52.4	4.35	6.40	0.732	80.1															
4	06/28/04	12:52	Surface	0.1	27.3	98.8	7.82	7.03	0.695	55.8	3.8	5	5.0	0.2	0.68	0.68	< 0.01	< 0.03	0.011	< 0.005	6.09	2.2	3.3	< 0.0025	< 0.05
4	06/28/04	12:49	Mid-depth	1.0	27.0	93.8	7.49	6.80	0.699	55.8															
4	06/28/04	12:46	Mid-depth	4.0	26.8	83.3	6.69	6.52	0.713	56.4															
4	06/28/04	12:43	Mid-depth	7.0	25.8	42.3	3.46	6.19	0.722	60.0															
4	06/28/04	12:40	Bottom	10.0	25.6	41.5	3.30	6.11	0.725	60.0															
5	06/28/04	13:18	Surface	0.1	27.5	98.0	7.77	7.18	0.595	55.5	3.8	7	7.6	0.1	0.53	0.53	< 0.01	< 0.03	0.007	< 0.005	5.93	4.4	3.16	< 0.0025	< 0.05
5	06/28/04	13:15	Mid-depth	1.0	26.6	91.2	7.32	6.74	0.514	55.8															
5	06/28/04	13:12	Mid-depth	4.0	26.6	87.6	7.06	6.70	0.594	55.6															
5	06/28/04	13:09	Mid-depth	7.0	26.5	86.0	6.94	6.48	0.591	55.9						0.54	0.53	0.01	< 0.03	0.008	< 0.005				
5	06/28/04	13:06	Mid-depth	4.0	26.6	87.6	7.06	6.70	0.594	55.6															
5	06/28/04	13:03	Mid-depth	1																					

CHESTERFIELD COUNTY UTILITIES DEPARTMENT																									
ADDISON-EVANS WATER PRODUCTION FACILITY																									
RESULTS OF 2004 RESERVOIR SURVEY WATER QUALITY ANALYSES (JANUARY - DECEMBER)																									
STATION	DATE	TIME	DEPTH	DEPTH	TEMPERATURE	DISSOLVED	DISSOLVED	SECCI	FECAL	TOTAL KJELDAHL	OXIDIZED	AMMONIA	TOTAL	ORTHOPHOSPHATE	TOTAL ORGANIC	TOTAL SUSPENDED	TURBIDITY	LEAD	ZINC						
			DATE	TIME	(Feet)	(Degrees Celsius)	(% SATURATION)	(mg/L)	pH	ORP	CONDUCTIVITY	DISK	COLIFORM	CHLOROPHYLL a	PHEOPHYTIN a	TOTAL NITROGEN	NITROGEN	NITROGEN	PHOSPHORUS	PHOSPHORUS	CARBON	SOLIDS	(ntu)	(mg/L)	(mg/L)
8	08/06/04	09:30			Bottom	23.0	20.9	4.0	0.38	6.91	0.296	137.0				0.57	0.57	< 0.01	< 0.03	0.052	0.011				
1	08/18/04	10:51	Surface	0.1	24.7	95.8	7.99	6.04	0.762	31.3	1.8	39	14.8	0.5	0.55	0.55	< 0.01	< 0.03	0.058	0.010	12.5	12	14.2	< 0.0025 < 0.05	
1	08/18/04	10:48	Mid-depth	2.0	24.1	80.3	6.79	5.95	0.767	34.9															
1	08/18/04	10:45	Bottom	5.0	22.2	35.1	3.07	5.81	0.783	42.4															
2	08/18/04	11:36	Surface	0.1	24.7	97.0	8.08	5.97	0.697	29.9	2.0	13	17.3	0.6	0.54	0.54	< 0.01	< 0.03	0.058	0.010	12.5	12	14.9	< 0.0025 < 0.05	
2	08/18/04	11:33	Mid-depth	3.0	24.2	82.5	6.95	5.86	0.702	29.9															
2	08/18/04	11:30	Bottom	6.0	21.9	27.5	2.41	5.64	0.700	36.4															
3	08/18/04	15:27	Surface	0.1	25.4	98.8	8.12	6.65	0.602	47.3	1.2	29	15.5	0.4	0.57	0.57	< 0.01	< 0.03	0.041	0.006	9.17	10	14.6	< 0.0025 < 0.05	
* Total nitrogen is calculated as the sum of total kjeldahl nitrogen and total oxidized nitrogen																									
** Data excluded due to analytical error.																									
*** Orthophosphate measured greater than total phosphorus, however within analytical methods error.																									
3	08/18/04	15:24	Mid-depth	1.0	25.4	70.0	6.22	6.22	0.607	48.6															
3	08/18/04	15:21	Mid-depth	4.0	23.2	66.3	5.65	6.20	0.610	49.1															
3	08/18/04	15:18	Mid-depth	7.0	22.0	53.2	4.45	6.11	0.603	46.6															
3	08/18/04	15:15	Bottom	10.0	21.7	36.3	3.20	6.04	0.597	44.5															
4	08/18/04	15:07	Surface	0.1	21.1	111.0	8.68	7.11	0.587	39.7	3.0	5	9.6	0.3	0.58	0.58	< 0.01	< 0.03	0.035	< 0.005	9.88	4.4	4.94	< 0.0025 < 0.05	
4	08/18/04	15:04	Mid-depth	1.0	26.7	8.54	7.10	0.593	39.9																
4	08/18/04	15:01	Mid-depth	4.0	25.3	75.9	6.24	6.30	0.600	40.1															
4	08/18/04	14:58	Mid-depth	7.0	24.0	57.7	4.83	6.13	0.602	38.9															
4	08/18/04	14:55	Bottom	10.0	23.0	22.7	1.97	6.08	0.598	39.4															
5	08/18/04	14:50	Surface	0.1	26.9	112.0	8.94	7.34	0.582	39.7	3.0	5	16.1	0.4	0.56	0.56	< 0.01	< 0.03	0.035	< 0.005	10	3.2	5.38	< 0.0025 < 0.05	
5	08/18/04	14:47	Mid-depth	3.0	24.8	67.8	5.63	5.76	0.595	39.9															
5	08/18/04	14:44	Mid-depth	6.0	25.3	86.0	7.08	6.41	0.596	39.5															
5	08/18/04	14:41	Mid-depth	9.0	24.4	61.5	5.75	6.05	0.600	39.7															
5	08/18/04	14:38	Mid-depth	12.0	25.3	86.0	7.08	6.41	0.596	39.5															
5	08/18/04	14:35	Bottom	15.0	22.6	27.1	2.35	5.71	0.602	37.9															
6	08/18/04	14:25	Surface	0.1	25.8	85.3	6.90	5.94	0.591	40.3	2.5	23	14.3	0.5	0.53	0.53	< 0.01	< 0.03	0.041	0.006	9.87	6.6	9.32	< 0.0025 < 0.05	
6	08/18/04	14:22	Mid-depth	3.0	24.8	67.8	5.63	5.76	0.595	39.9															
6	08/18/04	14:19	Mid-depth	6.0	23.3	41.1	3.54	5.50	0.601	39.1															
6	08/18/04	14:16	Mid-depth	9.0	23.0	38.1	3.28	5.58	0.599	35.1															
6	08/18/04	14:13	Mid-depth	12.0	22.8	30.7	2.65	5.56	0.598	36.6															
6	08/18/04	14:10	Bottom	15.0	22.5	25.8	2.24	5.55	0.597	37.7															
7	08/18/04	14:02	Surface	0.1	25.9	92.8	7.55	6.36	0.602	40.4	2.4	16	11.1	0.4	0.52	0.52	< 0.01	< 0.03	0.040	0.006	9.88	7	9.04	< 0.0025 &	

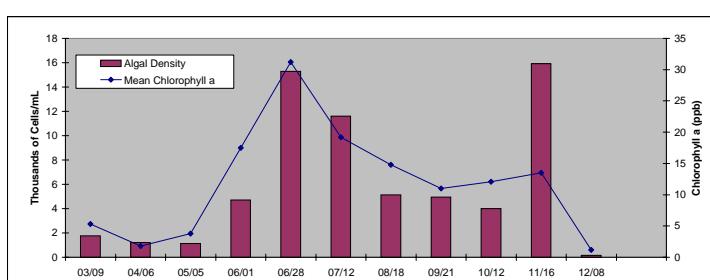
CHESTERFIELD COUNTY UTILITIES DEPARTMENT																											
ADDISON-EVANS WATER PRODUCTION FACILITY																											
RESULTS OF 2004 RESERVOIR SURVEY WATER QUALITY ANALYSES (JANUARY - DECEMBER)																											
STATION	DATE	TIME	DEPTH	DEPTH	TEMPERATURE	DISSOLVED	DISSOLVED	SECCI	FECAL	TOTAL KJELDAHL	OXIDIZED	AMMONIA	TOTAL	ORTHOPHOSPHATE	TOTAL ORGANIC	TOTAL SUSPENDED	TURBIDITY	LEAD	ZINC								
			FT	(Feet)	(Degrees Celsius)	OXYGEN	OXYGEN	ORP	CONDUCTIVITY	DISK	COLIFORM	CHLOROPHYLL a	PHEOPHYTIN a	TOTAL NITROGEN	NITROGEN	NITROGEN	PHOSPHORUS	PHOSPHORUS	CARBON	SOLIDS	(ntu)	(mg/L)					
5	10/26/04	11:23	Surface	0.1	16.2	68.7	6.81	6.39	0.747	24.6	3.2			8.6	0.3	0.61	0.58	0.03	< 0.03	0.041	0.010	8.29	5.6	6.7	< 0.0025	< 0.05	
5	10/26/04	11:20	Mid-depth	2.0	16.1	68.4	6.80	6.37	0.747	24.7																	
5	10/26/04	11:17	Mid-depth	5.0	15.6	66.0	6.62	6.36	0.747	24.8																	
5	10/26/04	11:14	Mid-depth	8.0	15.5	65.1	6.54	6.36	0.745	24.7																	
5	10/26/04	11:11	Mid-depth	11.0	15.4	66.3	6.68	6.35	0.744	24.6																	
5	10/26/04	11:08	Mid-depth	14.0	15.4	66.2	6.68	6.35	0.744	24.6																	
5	10/26/04	11:05	Bottom	17.0	15.4	63.9	6.44	6.35	0.751	25.2																	
8	10/26/04	11:54	Surface	0.1	16.3	63.2	6.25	6.38	0.725	24.3	3.1				5.4	0.2	0.62	0.59	0.03	< 0.03	0.035	0.011	8.02	5.6	6.78	< 0.0025	< 0.05
8	10/26/04	11:51	Mid-depth	1.0	16.1	62.8	6.20	6.33	0.725	24.4																	
8	10/26/04	11:48	Mid-depth	4.0	15.8	60.3	6.03	6.33	0.726	24.4																	
8	10/26/04	11:45	Mid-depth	7.0	15.8	60.1	6.00	6.30	0.726	24.4																	
8	10/26/04	11:42	Mid-depth	10.0	15.8	59.6	5.97	6.32	0.726	24.4																	
* Total nitrogen is calculated as the sum of total kjeldahl nitrogen and total oxidized nitrogen																											
** Data excluded due to analytical error.																											
*** Orthophosphate measured greater than total phosphorus, however within analytical methods error.																											
8	10/26/04	11:39	Mid-depth	13.0	15.8	61.0	6.10	6.30	0.725	24.4																	
8	10/26/04	11:36	Mid-depth	16.0	15.7	61.1	6.11	6.35	0.726	24.4																	
8	10/26/04	11:33	Mid-depth	19.0	15.7	60.4	6.05	6.36	0.724	24.4																	
8	10/26/04	11:30	Bottom	22.0	15.7	60.4	6.04	6.36	0.723	24.6																	
1	11/16/04	14:29	Surface	0.1	8.7	77.6	9.18	6.07	0.450	45.5	2.3	770	13.5	0.1	0.49	0.48	0.01	< 0.03	0.020	0.005	**	6.8	10.9	< 0.0025	< 0.05		
1	11/16/04	14:26	Mid-depth	2.0	8.1	74.4	8.86	6.08	0.450	45.8																	
1	11/16/04	14:23	Mid-depth	5.0	8.0	74.3	8.80	6.13	0.450	45.6																	
1	11/16/04	14:20	Bottom	8.0	8.0	72.5	8.72	6.10	0.450	45.5																	
2	11/16/04	14:16	Surface	0.1	9.5	80.3	9.30	6.40	0.452	40.6	2.2	613	10.1	0.1	0.43	0.42	0.01	< 0.03	0.017	< 0.005	**	8.8	11.3	< 0.0025	< 0.05		
2	11/16/04	14:13	Mid-depth	3.0	8.6	75.0	8.90	6.50	0.449	40.5																	
2	11/16/04	14:10	Bottom	6.0	8.5	71.7	8.51	6.55	0.442	38.2																	
3	11/16/04	14:04	Surface	0.1	9.5	83.4	9.64	6.25	0.446	54.2	2.0	57	11.1	0.2	0.50	0.45	0.05	< 0.03	0.014	< 0.005	**	6.4	9.79	< 0.0025	< 0.05		
3	11/16/04	14:01	Mid-depth	2.0	9.1	79.5	9.32	6.25	0.445	56.2																	
3	11/16/04	13:58	Mid-depth	5.0	9.0	78.3	9.20	6.25	0.445	56.6																	
3	11/16/04	13:55	Mid-depth	8.0	8.7	76.8	9.06	6.25	0.447	55.7																	
3	11/16/04	13:52	Bottom	11.0	8.7	76.7	9.05	6.23	0.447	55.6																	
4	11/16/04	13:47	Surface	0.1	12.6	92.2	10.00	6.13	0.454	35.4	2.8	50	15.2	0.2	0.46	0.42	0.04	< 0.03	0.015	< 0.005	**	6.8	7.04	< 0.0025	< 0.05		
4	11/16/04	13:44	Mid-depth	1.0	11.9	92.0	10.00	6.16	0.454	35.4																	
4	11/16/04	13:41	Mid-depth	4.0	11.0	85.0	9.57	6.34	0.453	35.7																	
4	11/16/04	13:38	Mid-depth	7.0	1																						

2004 Reservoir and Watershed Report

Appendix C: Reservoir Algae Data

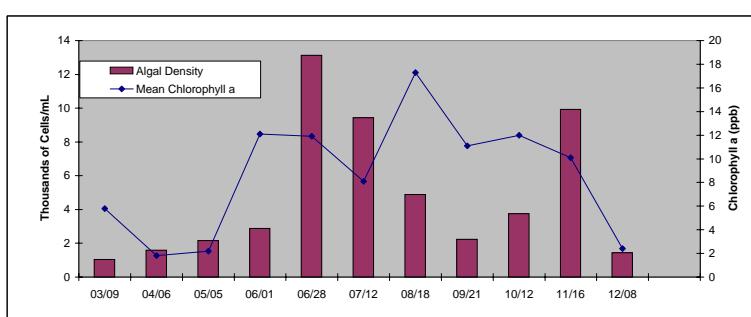
2004 PHYTOPLANKTON ASSESSMENT OF SWIFT CREEK RESERVOIR SITE 1

PHYTOPLANKTON CELL DENSITY COUNTS (Cells / mL)														
TAXON	01/13	02/10	03/09	04/06	05/05	06/01	06/28	07/12	08/18	09/21	10/12	11/16	12/08	
CHLOROPHYTA	ITE FROZEN SITE FROZEN													
<i>Ankistrodesmus</i>			80	80	80	1040	1760	960	800		640	160		
<i>Chlorella</i>						240	80	240						
<i>Chotadella</i>								80				160		
<i>Closteriopsis</i>								80						
<i>Crucigenia</i>								560	1280	320	320	640		
<i>Dictyosphaerium</i>		320			320	5440	4640							
<i>Elakatothrix</i>						80	80							
<i>Euastrum</i>								320						
<i>Golenkinia</i>							240	80	80					
<i>Kirchneriella</i>							320	960			960			
<i>Micractinium</i>											80			
<i>Oedogonium</i>												160		
<i>Oocystis</i>								320						
<i>Pachycladon</i>						80								
<i>Pediastrum</i>							640	640				320		
<i>Polyedriopsis</i>								80						
<i>Scenedesmus</i>		160					480	1520	160					
<i>Tetraedron</i>					160	80	160	80	80	80		160		
CHRYPSOPHYTA														
<i>Asterionella</i>			320											
<i>Attheya</i>							80		80		80			
<i>Chrysochromulina</i>		160					80		240	160	320	13440		
<i>Chrysococcus</i>						320	400	240	560	80	80	320		
<i>Cyclotella</i>						160		240	80		80	80		
<i>Diceras</i>							240							
<i>Dinobryon</i>		80	80				720	80		80	720	80	80	
<i>Kephviron</i>		400				80		80			80		320	80
<i>Mallomonas</i>			80				80			80				
<i>Melosira</i>												480		
<i>Nitzschia</i>		80				80		1840	400		800	880	320	
<i>Rhizosolenia</i>		80					320	320				80		
<i>Synedra</i>							80							
<i>Tabellaria</i>								320					320	
EUGLENOPHYTA														
<i>Euglena</i>			80						160	80	80	160		
<i>Phacus</i>								160			80			
<i>Trachelomonas</i>							560	160	320	160	160	80		
CRYPTOPHYTA														
<i>Chroomonas</i>		240	480		560						160			80
<i>Cryptomonas</i>					80	80	160			960	880		160	
<i>Rhodomonas</i>				160										
PYRRHOPHYTA														
<i>Glenodinium</i>									80	80	160	80	240	
CYANOPROKARYOTA (Colonies counted only)														
<i>Arabaeena</i>						80		320						
<i>Anacystis (Aphanocapsa)</i>							400							
<i>Aphanizomenon</i>								80						
SUMMARY STATISTICS														
DENSITY (Cells / mL):														
CHLOROPHYTA	0	0	240	400	240	2160	10160	9280	2400	1600	1280	1120	0	
CHRYSPHYTA	0	0	1120	160	160	1680	3440	1280	1200	1920	2240	14640	80	
EUGLENOPHYTA	0	0	80	0	0	0	720	320	400	320	240	0	0	
CRYPTOPHYTA	0	0	240	640	640	80	160	0	960	1040	0	160	80	
PYRRHOPHYTA	0	0	0	0	0	0	0	80	80	160	80	240	0	0
CYANOPROKARYOTA	0	0	0	0	0	0	720	80	0	0	0	0	0	
UNKNOWN ALGAE	0	0	80	0	0	800	0	560	0	0	0	0	0	
TOTAL	0	0	1760	1200	1120	4720	15280	11600	5120	4960	4000	15920	160	
RELATIVE ABUNDANCE:														
CHLOROPHYTA	0.0%	0.0%	13.6%	33.3%	21.4%	45.8%	66.5%	80.0%	46.9%	32.3%	32.0%	7.0%	0.0%	
CHRYSPHYTA	0.0%	0.0%	63.6%	13.3%	14.3%	35.6%	22.5%	11.0%	23.4%	38.7%	56.0%	92.0%	50.0%	
EUGLENOPHYTA	0.0%	0.0%	4.5%	0.0%	0.0%	0.0%	4.7%	2.8%	7.8%	6.5%	6.0%	0.0%	0.0%	
CRYPTOPHYTA	0.0%	0.0%	13.6%	53.3%	57.1%	1.7%	1.0%	0.0%	18.8%	21.0%	0.0%	1.0%	50.0%	
PYRRHOPHYTA	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.5%	0.7%	3.1%	1.6%	6.0%	0.0%	0.0%	
CYANOPROKARYOTA	0.0%	0.0%	0.0%	0.0%	7.1%	0.0%	4.7%	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	
UNKNOWN ALGAE	0.0%	0.0%	4.5%	0.0%	0.0%	16.9%	0.0%	4.8%	0.0%	0.0%	0.0%	0.0%	0.0%	
TOTAL	0.0%	0.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	
TAXONOMIC RICHNESS:														
CHLOROPHYTA	0	0	2	2	2	7	10	12	5	5	3	4	1	
CHRYSPHYTA	0	0	6	2	2	6	9	5	7	6	7	7	0	
EUGLENOPHYTA	0	0	1	0	0	0	2	2	2	3	2	0	1	
CRYPTOPHYTA	0	0	1	2	2	1	1	0	1	2	0	1	0	
PYRRHOPHYTA	0	0	0	0	0	0	1	1	1	1	1	0	0	
CYANOPROKARYOTA	0	0	0	0	1	0	2	1	0	0	0	0	0	
UNKNOWN ALGAE	0	0	1	0	0	2	0	2	0	0	0	0	0	
TOTAL	0	0	11	6	7	16	25	23	16	17	13	12	2	
CHLOROPHYLL a (ug / L):														
TOTAL	0	0	5.3	1.8	3.8	17.5	31.2	19.2	14.8	11	12.1	13.5	1.2	



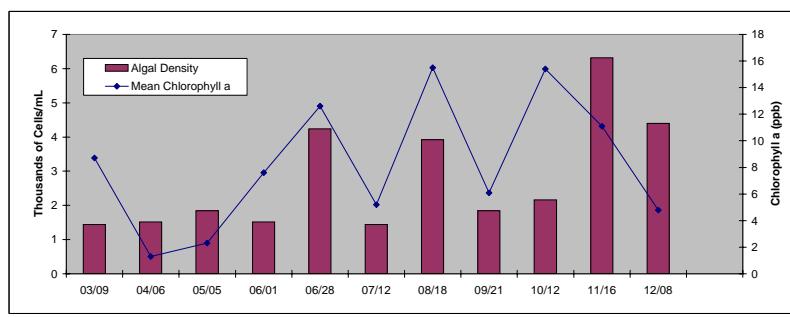
2004 PHYTOPLANKTON ASSESSMENT OF SWIFT CREEK RESERVOIR SITE 2

PHYTOPLANKTON CELL DENSITY COUNTS (Cells / mL)														
TAXON	01/13	02/10	03/09	04/06	05/05	06/01	06/28	07/12	08/18	09/21	10/12	11/16	12/08	
CHLOROPHYTA														
<i>Ankistrodesmus</i>				80	160	560	640	2000	1120	400	240	560	480	320
<i>Chlorella</i>						80	80	80	80	480				
<i>Chotadella</i>							80	80					80	
<i>Closteriopsis</i>							80	80						80
<i>Crucigenia</i>						240	1280	320				2240		
<i>Dictyosphaerium</i>							3360	3840	320					
<i>Elakatothrix</i>						480	160							
<i>Euastrum</i>									160					
<i>Golenkinia</i>							80	80						
<i>Kirchneriella</i>							800							
<i>Pediastrum</i>					320									
<i>Scenedesmus</i>							720	320	320				160	
<i>Staurastrum</i>							160	80						
<i>Tetraedron</i>				80	80	80	80	240			240	80		
CHRYPSOPHYTA														
<i>Attheya</i>							80	80	80					
<i>Centritractus</i>							80							
<i>Chrysocromulina</i>	80	80	160	240	80	80	240	80	240	8480	320			
<i>Chrysococcus</i>	80			240		320	640			160	160			
<i>Cyclotella</i>					80	80							80	
<i>Diceras</i>							400	80	80					
<i>Dinobryon</i>			80		160		80		320					
<i>Fragilaria</i>		80												
<i>Kephyrion</i>		80	320	240	80	80	160		80					
<i>Mallomonas</i>	80								80				160	
<i>Melosira</i>	160			320					160			160		
<i>Nitzschia</i>	80	80	80	80	1120	560	160		240	240	80			
<i>Rhizosolenia</i>					160	800	160	80						
<i>Stiptococcus</i>									160					
<i>Tabellaria</i>							640	320						
EUGLENOPHYTA														
<i>Euglena</i>								80	160		80			
<i>Phacus</i>								80		80				
<i>Trachelomonas</i>	80			80	80	480	560	80	80	80	80			
CRYPTOPHYTA														
<i>Chroomonas</i>				480	160				240				160	
<i>Cryptomonas</i>		160	160		80				1200	1040			80	
<i>Rhodomonas</i>					80									
PYRRHOPHYTA														
<i>Glenodinium</i>							80							
CYANOPROKARYOTA (Colonies counted only)														
<i>Anabaena</i>							240	80						
<i>Aphanizomenon</i>							560							
<i>Chroococcus</i>						160	80							
SUMMARY STATISTICS														
DENSITY (Cells / ml):														
CHLOROPHYTA	0	0	80	240	960	1520	8720	6320	1760	240	3040	800	400	
CHRYSOPHYTA	0	0	560	640	800	1040	2960	2160	1680	560	560	9040	800	
EUGLENOPHYTA	0	0	80	0	80	480	720	240	160	160	0	0	0	
CRYPTOPHYTA	0	0	160	640	160	160	0	0	1200	1280	0	80	240	
PYRRHOPHYTA	0	0	0	0	0	0	0	80	0	0	0	0	0	
CYANOPROKARYOTA	0	0	0	0	0	0	960	160	0	0	0	0	0	
UNKNOWN ALGAE	0	0	160	80	160	80	0	0	0	0	0	0	0	
TOTAL	0	0	1040	1600	2160	2880	13120	9440	4880	2240	3760	9920	1440	
RELATIVE ABUNDANCE:														
CHLOROPHYTA	0.0%	0.0%	7.7%	15.0%	44.4%	52.8%	66.5%	66.9%	36.1%	10.7%	80.9%	8.1%	27.8%	
CHRYSOPHYTA	0.0%	0.0%	53.8%	40.0%	37.0%	36.1%	22.6%	22.9%	34.4%	25.0%	14.9%	91.1%	55.6%	
EUGLENOPHYTA	0.0%	0.0%	7.7%	0.0%	3.7%	2.8%	3.7%	7.6%	4.9%	7.1%	4.3%	0.0%	0.0%	
CRYPTOPHYTA	0.0%	0.0%	15.4%	40.0%	7.4%	5.6%	0.0%	0.0%	24.6%	57.1%	0.0%	0.8%	16.7%	
PYRRHOPHYTA	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.8%	0.0%	0.0%	0.0%	0.0%	0.0%	
CYANOPROKARYOTA	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	7.3%	1.7%	0.0%	0.0%	0.0%	0.0%	0.0%	
UNKNOWN ALGAE	0.0%	0.0%	15.4%	5.0%	7.4%	2.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
TOTAL	0.0%	0.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	
TAXONOMIC RICHNESS:														
CHLOROPHYTA	0	0	1	2	3	5	11	10	6	1	3	4	2	
CHRYSOPHYTA	0	0	6	5	4	7	8	9	9	4	3	4	5	
EUGLENOPHYTA	0	0	1	0	1	1	1	3	2	2	2	0	0	
CRYPTOPHYTA	0	0	1	2	1	2	0	0	1	2	0	1	2	
PYRRHOPHYTA	0	0	0	0	0	0	0	1	0	0	0	0	0	
CYANOPROKARYOTA	0	0	0	0	0	0	3	2	0	0	0	0	0	
UNKNOWN ALGAE	0	0	1	1	2	1	0	0	0	0	0	0	0	
TOTAL	0	0	10	10	11	16	23	25	18	9	8	9	9	
CHLOROPHYLL a (ug / L):														
TOTAL	0	0	5.8	1.8	2.2	12.1	11.9	8.1	17.3	11.1	12	10.1	2.4	



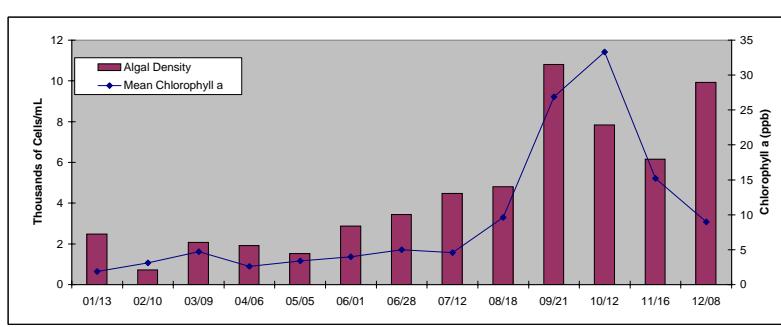
2004 PHYTOPLANKTON ASSESSMENT OF SWIFT CREEK RESERVOIR SITE 3

PHYTOPLANKTON CELL DENSITY COUNTS (Cells / mL)													
TAXON	01/13	02/10	03/09	04/06	05/05	06/01	06/28	07/12	08/18	09/21	10/12	11/16	12/08
CHLOROPHYTA	ITE FROZEN	SITE FROZEN											
<i>Ankistrodesmus</i>			160	320	80	400	320	240	80		160	1120	160
<i>Chlorella</i>							160						
<i>Chotadella</i>							80						160
<i>Clasteropsis</i>										80			
<i>Crucigenia</i>							320					480	
<i>Dictyosphaerium</i>							240	160	640				240
<i>Elakatothrix</i>						320		80					
<i>Euastrum</i>									320				
<i>Kirchneriella</i>									640		240		
<i>Micractinium</i>							560			640			
<i>Oocystis</i>								240					
<i>Scenedesmus</i>							480	240				960	
<i>Staurastrum</i>									80				
<i>Tetraedron</i>			80			80	80	160				240	
CHRYPSOPHYTA													
<i>Attheya</i>									80		80		
<i>Chryschromulina</i>					80				400	400	320	1440	1840
<i>Chrysococcus</i>							160	160	160				80
<i>Cyclotella</i>								80	80	160	160	960	160
<i>Diceras</i>						80			80			80	
<i>Dinobryon</i>	240	160			480						160		240
<i>Kephryion</i>	400	240				80				80			
<i>Mallomonas</i>									80				80
<i>Melosira</i>		160					320				240	960	
<i>Nitzschia</i>	160						240	80	160	80	160	240	160
<i>Rhizosolenia</i>	240				80	80			160		80	80	640
<i>Stipitococcus</i>						80							
<i>Tabellaria</i>						80							
EUGLENOPHYTA													
<i>Euglena</i>							80				80	80	
<i>Phacus</i>							80						
<i>Trachelomonas</i>							640		80				
CRYPTOPHYTA													
<i>Chroomonas</i>			80	240	1680				80				320
<i>Cryptomonas</i>			160	80		80	80			320	320		240
PYRRHOPHYTA													
<i>Glenodinium</i>					80					320		80	
CYANOPROKARYOTA (Colonies counted only)													
<i>Anabaena</i>									80				
SUMMARY STATISTICS													
DENSITY (Cells / ml):													
CHLOROPHYTA	0	0	160	400	80	800	2240	1120	1840	640	880	2320	560
CHRYPSOPHYTA	0	0	1040	560	80	640	1040	320	1200	880	1120	3680	3200
EUGLENOPHYTA	0	0	0	0	0	0	800	0	80	0	80	80	0
CRYPTOPHYTA	0	0	240	320	1680	80	80	0	400	320	0	240	640
PYRRHOPHYTA	0	0	0	80	0	0	0	0	320	0	80	0	0
CYANOPROKARYOTA	0	0	0	0	0	0	0	0	80	0	0	0	0
UNKNOWN ALGAE	0	0	0	160	0	0	80	0	0	0	0	0	0
TOTAL	0	0	1440	1520	1840	1520	4240	1440	3920	1840	2160	6320	4400
RELATIVE ABUNDANCE:													
CHLOROPHYTA	0.0%	0.0%	11.1%	26.3%	4.3%	52.6%	52.8%	77.8%	46.9%	34.8%	40.7%	36.7%	12.7%
CHRYPSOPHYTA	0.0%	0.0%	72.2%	36.8%	4.3%	42.1%	24.5%	22.2%	30.6%	47.8%	51.9%	58.2%	72.7%
EUGLENOPHYTA	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	18.9%	0.0%	2.0%	0.0%	3.7%	1.3%	0.0%
CRYPTOPHYTA	0.0%	0.0%	16.7%	21.1%	91.3%	5.3%	1.9%	0.0%	10.2%	17.4%	0.0%	3.8%	14.5%
PYRRHOPHYTA	0.0%	0.0%	0.0%	5.3%	0.0%	0.0%	0.0%	0.0%	8.2%	0.0%	3.7%	0.0%	0.0%
CYANOPROKARYOTA	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%	0.0%	0.0%	0.0%	0.0%
UNKNOWN ALGAE	0.0%	0.0%	0.0%	10.5%	0.0%	0.0%	1.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
TOTAL	0.0%	0.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
TAXONOMIC RICHNESS:													
CHLOROPHYTA	0	0	1	2	1	3	8	6	6	1	3	3	3
CHRYPSOPHYTA	0	0	4	3	1	3	7	3	8	5	7	5	7
EUGLENOPHYTA	0	0	0	0	0	0	3	0	1	0	1	1	0
CRYPTOPHYTA	0	0	2	2	1	1	1	0	2	1	0	1	2
PYRRHOPHYTA	0	0	0	1	0	0	0	0	1	0	1	0	0
CYANOPROKARYOTA	0	0	0	0	0	0	0	0	1	0	0	0	0
UNKNOWN ALGAE	0	0	0	1	0	0	1	0	0	0	0	0	0
TOTAL	0	0	7	9	3	7	20	9	19	7	12	10	12
CHLOROPHYLL a (ug / L):													
TOTAL	0	0	8.7	1.3	2.3	7.6	12.6	5.2	15.5	6.1	15.4	11.1	4.8



2004 PHYTOPLANKTON ASSESSMENT OF SWIFT CREEK RESERVOIR SITE 4

PHYTOPLANKTON CELL DENSITY COUNTS (Cells / mL)														
TAXON	01/13	02/10	03/09	04/06	05/05	06/01	06/28	07/12	08/18	09/21	10/12	11/16	12/08	
CHLOROPHYTA														
<i>Ankistrodesmus</i>	240		160	80	80	720	880	640	400	80	80	1200	3280	
<i>Chotadella</i>												80	160	
<i>Closteriopsis</i>							640	640		160	240			
<i>Crucigenia</i>										960	1360	640		
<i>Dictyosphaerium</i>	320								1040	320	320	240		
<i>Elakatothrix</i>								80						
<i>Euastrum</i>										320		320		
<i>Golenkinia</i>									80					
<i>Kirchneriella</i>									320					
<i>Micractinium</i>									880	640		800		
<i>Oocysts</i>							240							
<i>Pachycladon</i>									80					
<i>Scenedesmus</i>										320		320	640	
<i>Tetraedron</i>	80						80	80	160	80		80	240	
<i>Trebubaria</i>									80				80	
CHRYSOPHYTA														
<i>Asterionella</i>						800								
<i>Chrysochromulina</i>	160					80	80			800	1040	3280	400	3200
<i>Chrysococcus</i>										400	880	80	80	
<i>Cyclotella</i>						80	560	240			160	80	720	
<i>Diceras</i>							80				80		80	
<i>Dinobryon</i>			80											
<i>Fragilaria</i>							160							
<i>Kephnyton</i>		160				80	80							
<i>Melosira</i>	1120		800	160	800	160			480		800	800	480	1360
<i>Navicula</i>	80													
<i>Nitzschia</i>		80	80					80		240	240	160	240	160
<i>Rhizosolenia</i>	80	160	320	240				80		240	80		80	160
<i>Stictococcus</i>											240			
<i>Tabellaria</i>								560				1440	720	
EUGLENOPHYTA														
<i>Euglena</i>							80					80		
<i>Trachelomonas</i>			80						80	160	240			
CRYPTOPHYTA														
<i>Chroomonas</i>	240	160	160	240	80	80				160		80	320	400
<i>Cryptomonas</i>	80	160	160	80	80			80	80	160	1920	480	400	240
<i>Rhodomonas</i>	80		80	80							1680			
CYANOPROKARYOTA (Colonies counted only)														
<i>Araebaena</i>									160	160		80	80	
<i>Chroococcus</i>										1120				
SUMMARY STATISTICS														
DENSITY (Cells / ml):														
CHLOROPHYTA	640	0	160	80	80	1440	2240	2560	2560	2000	2160	3280	4320	
CHRYSOPHYTA	1440	400	1280	1360	1200	800	960	480	1760	4880	5040	2080	4960	
EUGLENOPHYTA	0	0	80	0	0	80	0	80	160	320	0	0	0	
CRYPTOPHYTA	400	320	400	400	160	80	80	80	320	3600	560	720	640	
CYANOPROKARYOTA	0	0	0	0	0	0	160	1280	0	0	80	80	0	
UNKNOWN ALGAE	0	0	160	80	80	480	0	0	0	0	0	0	0	
TOTAL	2480	720	2080	1920	1520	2880	3440	4480	4800	10800	7840	6160	9920	
RELATIVE ABUNDANCE:														
CHLOROPHYTA	25.8%	0.0%	7.7%	4.2%	5.3%	50.0%	65.1%	57.1%	53.3%	18.5%	27.6%	53.2%	43.5%	
CHRYSOPHYTA	58.1%	55.6%	61.5%	70.8%	78.9%	27.8%	27.9%	10.7%	36.7%	45.2%	64.3%	33.8%	50.0%	
EUGLENOPHYTA	0.0%	0.0%	3.8%	0.0%	0.0%	2.8%	0.0%	1.8%	3.3%	3.0%	0.0%	0.0%	0.0%	
CRYPTOPHYTA	16.1%	44.4%	19.2%	20.8%	10.5%	2.8%	2.3%	1.8%	6.7%	33.3%	7.1%	11.7%	6.5%	
CYANOPROKARYOTA	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.7%	28.6%	0.0%	0.0%	1.0%	1.3%	0.0%	
UNKNOWN ALGAE	0.0%	0.0%	7.7%	4.2%	5.3%	16.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
TOTAL	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	
TAXONOMIC RICHNESS:														
CHLOROPHYTA	3	0	1	1	1	3	6	8	7	4	6	6	4	
CHRYSOPHYTA	4	3	4	5	5	3	4	1	5	8	5	7	5	
EUGLENOPHYTA	0	0	1	0	0	1	0	1	1	2	0	0	0	
CRYPTOPHYTA	3	2	3	3	2	1	1	1	2	2	2	2	2	
CYANOPROKARYOTA	0	0	0	0	0	0	1	2	0	0	1	1	0	
UNKNOWN ALGAE	0	0	1	1	1	0	0	0	0	0	0	0	0	
TOTAL	10	5	10	10	9	9	12	13	15	16	14	16	11	
CHLOROPHYLL a (ug / L):														
TOTAL	1.9	3.1	4.7	2.6	3.4	4	5	4.6	9.6	26.9	33.3	15.2	9	



PHYTOPLANKTON CELL DENSITY COUNTS (Cells / mL)																																															
TAXON	01/13	02/10	02/23	03/09	03/24	04/06	04/19	05/05	05/19	06/01	06/14	06/28	07/12	07/30	08/06	08/18	09/21	09/30	10/12	10/26	11/16	11/30	12/08	12/29																							
CHLOROPHYTA																																															
<i>Ankistrodesmus</i>	560	160	80	80	80	160	320	240	1840	1920	240	560	720	240	80	400	480	160		480	3760	2640	2000																								
<i>Chlamydomonas</i>						80											80																														
<i>Chlorella</i>	80			80																																											
<i>Chotadella</i>																					160				480																						
<i>Closteriumopsis</i>													320		160		80																														
<i>Coelastrum</i>							320							640			320	240	320	2960	240	1280	320	320	2480	560	560																				
<i>Crucigenia</i>	2560																					560																									
<i>Dicytosphaerium</i>		320	320	1360	320									240	320	320	320	240	1200	320			560																								
<i>Ekmanochlorix</i>	160													80																																	
<i>Eustromma</i>																					480																										
<i>Kirchneriella</i>																	1280	160																													
<i>Micracium</i>																	1040		320			320																									
<i>Oocystis</i>																			160	160	160					320																					
<i>Scenedesmus</i>								160											160	160					960	1120	480																				
<i>Tetraedron</i>	80									80	160	80	400	160	80			80	80			160	240	80	240	880																					
<i>Treubaria</i>																																															
CHRYSPHYTA																																															
<i>Asterionella</i>	400	1120	240			320																																									
<i>Athyra</i>														80																																	
<i>Chrysocromulina</i>	160		8960	640		160	640	80						80			240	160	880	160	80	2080	160	1600	1520	1200	9680																				
<i>Chrysococcus</i>	640		160														80	320	400						80																						
<i>Cyclotella</i>										80	1200	80			160	240	80			160	80	80			80			80																			
<i>Diceras</i>										80																																					
<i>Dinobryon</i>		160	160	80														80																													
<i>Flagellata</i>																																															
<i>Kephnyton</i>	80		640	160	320	160	720							80	80			80		320	240							80		80																	
<i>Leptothrix</i>										80																																					
<i>Mallomonas</i>																																															
<i>Melosira</i>	1440	640	320	880	640	720	640	960		640	960	160	640					80	320	80	320	80	160	880		1920	560	1760	1440																		
<i>Navicula</i>								80	80																																						
<i>Nitzschia</i>	240		80	80	80																																										
<i>Rhizosolenia</i>	80		240	160	320	400	400																																								
<i>Tabellaria</i>																																															
EUGLENOPHYTA																																															
<i>Euglena</i>																																															
<i>Trachelomonas</i>														80		80		160																80													
CRYPTOPHYTA																																															
<i>Chroomonas</i>	320	320	80	480		80	160	240	160	240	160						80	80	400	960	560	160	80	480	2480	720	560																				
<i>Cryptomonas</i>	480	240	240	240	240									160		80	80	240	960	800	480	720			160	640	640	240																			
PYRRHOPHYTA																																															
<i>Glenodinium</i>																																															
CYANOPROKARYOTA (Colonies counted only)																																															
<i>Chroococcus</i>																																															
<i>Merismopedia</i>																	80		160																												

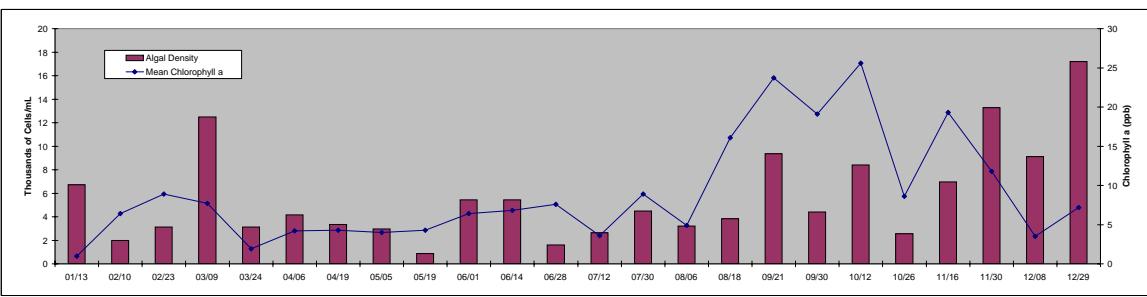
SUMMARY STATISTICS

DENSITY (Cells / mL)	
CHLOROPHYTA	3360
CHRYSPHYTA	2480
EUGLENOPHYTA	0
CRYPTOPHYTA	880
PYRRHOPHYTA	0
CYANOPROKARYOTA	0
UNKNOWN ALGAE	0
TOTAL	6720

RELATIVE ABUNDANCE:	
CHLOROPHYTA	50.0%
CHRYSPHYTA	9.7%
EUGLENOPHYTA	0.0%
CRYPTOPHYTA	13.6%
PYRRHOPHYTA	0.0%
CYANOPROKARYOTA	0.0%
UNKNOWN ALGAE	0.0%
TOTAL	100.0%

TAXONOMIC RICHNESS:	
CHLOROPHYTA	4
CHRYSPHYTA	5
EUGLENOPHYTA	0
CRYPTOPHYTA	3
PYRRHOPHYTA	0
CYANOPROKARYOTA	0
UNKNOWN ALGAE	0
TOTAL	12

NOTE: ANABAENA AND MICROCYSTIS BLOOM ON 10/26/04.



PHYTOPLANKTON CELL DENSITY COUNTS (Cells / mL)														
TAXON	01/13	02/10	03/09	04/06	05/05	06/01	06/28	07/12	07/30	08/18	09/21	10/12	11/16	12/08
CHLOROPHYTA									Special Survey					
Ankistrodesmus	400	80	80	80	160	2000	480	240	400	1120	240	80	960	1520
Chlamydomonas			80											
Chotadella	160								80				80	
Closteriopsis														
Crucigenia	320			320		320		320	1760	1600			320	640
Dictyosphaerium				160	880			320	240		320		320	
Elakatothrix						320							160	
Euastrum									320	160		160		
Kirchneriella					640							320		
Micractinium									480	240	80		320	
Scenedesmus								320				320	800	320
Tetraedron	240				80	160	80	160				160	240	
Trebularia								160	80		80			
Ulothrix		640												
CHRYPSOPHYTA														
Asterionella		640		320										
Attheya											80			
Biddulphia							80	160						
Chrysocromulina	240	400	10560	80			160		240	160	880	1600	1680	1520
Chrysococcus	160						80			240	1280			
Cyclotella	160					480	320	240	80	80			960	80
Cymbella		80												
Dinobryon			400										80	
Fragilaria			560	80										
Kephryion	80	160	160	160	80									
Mallomonas						80	80		240		80	160		
Melosira	7360			1600	160	320	960					1360	1200	1440
Navicula		80		160										
Nitzschia	240		320		80				160	320	480	80	480	320
Rhizosolenia	80	320	240	480		160	80			80		80	160	
Tabellaria													720	
EUGLENOPHYTA														
Euglena									80	160	80		80	
Trachelomonas									80	80	800	80	80	
CRYPTOPHYTA														
Chroomonas	160	80	80	80	240	80	80		160	320	1680	400	2240	240
Cryptomonas	240		80		160		80	240	640	640	960	640	560	160
Rhodomonas			80											
PYRRHOPHYTA														
Glenodinium	80	240	160											
CYANOPROKARYOTA (Colonies counted only)														
Anabaena							240	80		80				
Chroococcus								160						
Merismopedia								80						

SUMMARY STATISTICS**DENSITY (Cells / mL):**

CHLOROPHYTA	1120	720	320	1280	880	2800	880	1440	3120	3440	400	1040	2560	2800
CHRYSOPHYTA	8320	1600	11360	3760	400	1040	1760	400	720	880	2800	4000	4560	3360
EUGLENOPHYTA	0	0	0	0	0	0	0	0	160	240	880	80	160	0
CRYPTOPHYTA	400	80	160	160	400	80	160	240	800	960	2640	1040	2800	400
PYRRHOPHYTA	80	240	160	0	0	0	0	0	0	0	0	0	0	0
CYANOPROKARYOTA	0	0	0	0	0	0	240	320	0	80	0	0	0	0
UNKNOWN ALGAE	0	0	560	720	240	1600	0	0	0	0	0	0	0	0
TOTAL	9920	2640	12560	5920	1920	5520	3040	2400	4800	5600	6720	6160	10080	6560

RELATIVE ABUNDANCE:

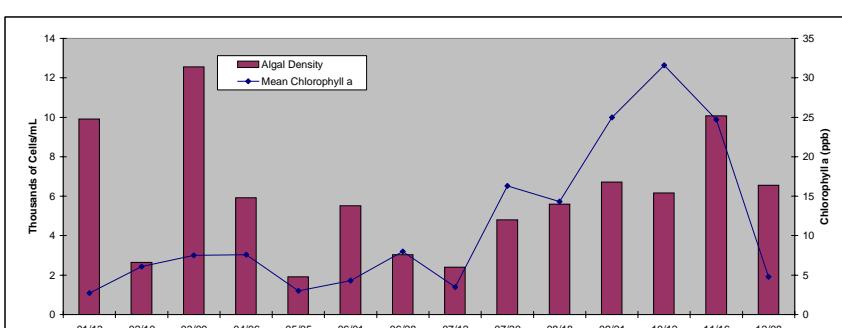
CHLOROPHYTA	11.3%	27.3%	2.5%	21.6%	45.8%	50.7%	28.9%	60.0%	65.0%	61.4%	6.0%	16.9%	25.4%	42.7%
CHRYSOPHYTA	83.9%	60.6%	90.4%	63.5%	20.8%	18.8%	57.9%	16.7%	15.0%	15.7%	41.7%	64.9%	45.2%	51.2%
EUGLENOPHYTA	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.3%	4.3%	13.1%	1.3%	1.6%	0.0%
CRYPTOPHYTA	4.0%	3.0%	1.3%	2.7%	20.8%	1.4%	5.3%	10.0%	16.7%	17.1%	39.3%	16.9%	27.8%	6.1%
PYRRHOPHYTA	0.8%	9.1%	1.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
CYANOPROKARYOTA	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	7.9%	13.3%	0.0%	1.4%	0.0%	0.0%	0.0%	0.0%
UNKNOWN ALGAE	0.0%	0.0%	4.5%	12.2%	12.5%	29.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
TOTAL	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

TAXONOMIC RICHNESS:

CHLOROPHYTA	4	2	3	3	3	4	3	6	6	5	3	5	6	4
CHRYSOPHYTA	7	5	5	8	4	4	7	2	4	5	5	6	6	4
EUGLENOPHYTA	0	0	0	0	0	0	0	2	2	2	1	2	0	
CRYPTOPHYTA	2	1	2	2	2	1	2	1	2	2	2	2	2	2
PYRRHOPHYTA	1	1	1	0	0	0	0	0	0	0	0	0	0	0
CYANOPROKARYOTA	0	0	0	0	0	0	1	3	0	1	0	0	0	0
UNKNOWN ALGAE	0	0	1	1	1	1	0	0	0	0	0	0	0	0
TOTAL	14	9	12	14	10	10	13	12	14	15	12	14	16	10

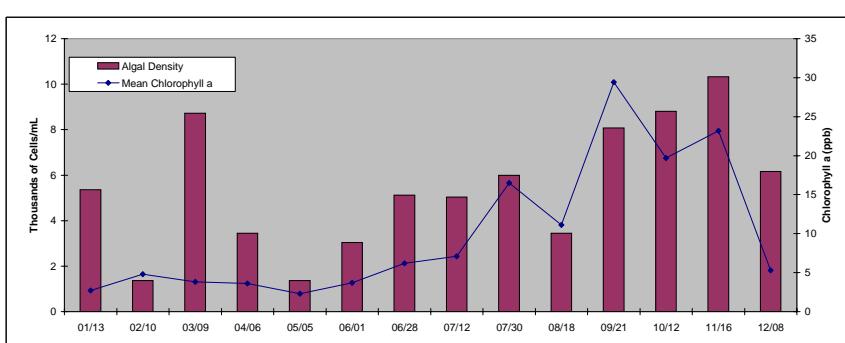
CHLOROPHYLL a (ug / L):

TOTAL	2.7	6.1	7.5	7.6	3	4.3	8	3.5	16.3	14.3	25	31.6	24.7	4.8
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2004 PHYTOPLANKTON ASSESSMENT OF SWIFT CREEK RESERVOIR SITE 7

PHYTOPLANKTON CELL DENSITY COUNTS (Cells / mL)														
TAXON	01/13	02/10	03/09	04/06	05/05	06/01	06/28	07/12	07/30	08/18	09/21	10/12	11/16	12/08
CHLOROPHYTA									Special Survey					
<i>Ankistrodesmus</i>	800	640	320	640	80	1520	80	640	400	720	320	640	2640	1680
<i>Chlamydomonas</i>			80											
<i>Chlorella</i>	480				160			240						
<i>Chotadella</i>							80	240	240	80			80	240
<i>Closteriopsis</i>								80	240	240				
<i>Crucigenia</i>	960					400	320	1280		1840	320		1280	320
<i>Dicyosphaerium</i>									720	720	1200	640	480	1280
<i>Elakatothrix</i>							80	80						
<i>Euastrum</i>											160			
<i>Kirchneriella</i>										480				
<i>Micractinium</i>											80	880	480	
<i>Oocystis</i>	320													
<i>Scenedesmus</i>	160							640	320		640	160	320	1280
<i>Tetraedron</i>			80		80							160		80
<i>Tetrasrum</i>									320					160
<i>Treubaria</i>											160			
CHRYOSOPHYTA														
<i>Asterionella</i>				240										
<i>Attheya</i>							80			80	80	80	80	80
<i>Biddulphia</i>								80	80					
<i>Centrotractus</i>														
<i>Chrysochromulina</i>	160		5440	560						240		640	1680	1680
<i>Chrysococcus</i>	160								80	80	240	160	800	80
<i>Cyclotella</i>				80			560	80	320	160	80		160	880
<i>Dinobryon</i>			320	320	80									
<i>Kephlyron</i>	80		560	640					160					
<i>Mallomonas</i>				80					80	80				80
<i>Melosira</i>	1280		880			320	160	480	480		320	480	1920	160
<i>Navicula</i>			80											
<i>Nitzschia</i>	240		80				80	80	80			240	160	240
<i>Rhizosolenia</i>	80	160	160	560				80		160	80		160	320
<i>Stictococcus</i>											80			
<i>Tabellaria</i>								640				640		
EUGLENOPHYTA														
<i>Euglena</i>										240		80	160	
<i>Trachelomonas</i>	80						80	80	80	160		560		80
CRYPTOPHYTA														
<i>Chroomonas</i>	320		80	160	80	160		80				1760	160	480
<i>Cryptomonas</i>	240		80			80		160		400	240	1360	240	320
<i>Rhodomonas</i>				80								80	80	80
PYRRHOPHYTA														
<i>Glenodinium</i>				80							80		80	
CYANOPROKARYOTA (Colonies counted only)														
<i>Anabaena</i>									160	160	80	80		
<i>Merismopedia</i>									1040					
SUMMARY STATISTICS														
DENSITY (Cells / mL):														
CHLOROPHYTA	2720	640	480	640	720	1920	2880	2480	4160	2080	1440	3840	6160	3200
CHRYOSOPHYTA	2000	320	7360	2480	400	880	1600	1280	960	960	2800	4160	3120	2240
EUGLENOPHYTA	80	0	0	0	0	80	80	80	400	0	640	160	80	80
CRYPTOPHYTA	560	160	240	80	240	0	240	0	400	240	3200	480	960	640
PYRRHOPHYTA	0	0	80	0	0	0	0	0	0	80	0	80	0	0
CYANOPROKARYOTA	0	0	0	0	0	0	0	160	1200	80	80	0	80	0
UNKNOWN ALGAE	0	240	560	240	0	160	160	0	0	0	0	0	0	0
TOTAL	5360	1360	8720	3440	1360	3040	5120	5040	6000	3440	8080	8800	10320	6160
RELATIVE ABUNDANCE:														
CHLOROPHYTA	50.7%	47.1%	5.5%	18.6%	52.9%	63.2%	56.3%	49.2%	69.3%	60.5%	17.8%	43.6%	59.7%	51.9%
CHRYOSOPHYTA	37.3%	23.5%	84.4%	72.1%	29.4%	28.9%	31.3%	25.4%	16.0%	27.9%	34.7%	47.3%	30.2%	36.4%
EUGLENOPHYTA	1.5%	0.0%	0.0%	0.0%	0.0%	2.6%	1.6%	1.6%	6.7%	0.0%	7.9%	1.8%	0.8%	1.3%
CRYPTOPHYTA	10.4%	11.8%	2.8%	2.3%	17.6%	0.0%	4.7%	0.0%	6.7%	7.0%	39.6%	5.5%	9.3%	10.4%
PYRRHOPHYTA	0.0%	0.0%	0.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.3%	0.0%	0.9%	0.0%	0.0%
CYANOPROKARYOTA	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.1%	23.8%	1.3%	2.3%	0.0%	0.9%	0.0%	0.0%
UNKNOWN ALGAE	0.0%	17.6%	6.4%	7.0%	0.0%	5.3%	3.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
TOTAL	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
TAXONOMIC RICHNESS:														
CHLOROPHYTA	5	1	3	1	4	3	6	6	5	6	6	6	7	5
CHRYOSOPHYTA	6	3	5	7	2	4	8	7	6	6	6	6	6	4
EUGLENOPHYTA	1	0	0	0	0	1	1	1	2	0	2	1	1	1
CRYPTOPHYTA	2	2	2	1	2	0	2	0	1	1	3	3	3	3
PYRRHOPHYTA	0	0	1	0	0	0	0	0	0	1	0	1	0	0
CYANOPROKARYOTA	0	0	0	0	0	0	1	2	1	1	0	1	0	0
UNKNOWN ALGAE	0	1	1	1	0	2	1	0	0	0	0	0	0	0
TOTAL	14	7	12	10	8	10	19	16	15	15	17	18	17	13
CHLOROPHYLL a (ug/L):														
TOTAL	2.7	4.8	3.8	3.6	2.3	3.7	6.2	7.1	16.5	11.1	29.4	19.7	23.2	5.3



PHYTOPLANKTON CELL DENSITY COUNTS (Cells / mL)																											
CHLOROPHYTA																											
<i>Ankistrodesmus</i>	880	80		240	240	160	400	160	160	880	1200	160	880	560	80	800	320	280	320	240	960	3760	1680	640			
<i>Chlamydomonas</i>							80																				
<i>Chlorella</i>														560	880	240											
<i>Closteriosiopsis</i>		80																								160	80
<i>Cruciaria</i>																											
<i>Dicyosphaerium</i>																											
<i>Elakatobrix</i>	1040	400	240	320				320	1280	320	320	320	960	1280												400	240
<i>Eustrom</i>															560												
<i>Golenkinia</i>																											
<i>Kirchneriella</i>																											
<i>Micractinium</i>																											
<i>Microcoleus</i>	240														240												
<i>Scenedesmus</i>																80	320										
<i>Sphaeroplea</i>																											
<i>Tetraedron</i>	240															80	80	320	80								
<i>Ulothrix</i>																240											
CHRYOSOPHYTA																											
<i>Asterionella</i>		400																									
<i>Attheya</i>																											
<i>Centricratus</i>																											
<i>Chloromonas</i>																											
<i>Chrysococcus</i>	80		720	5040	160	400		240		80	160																
<i>Cyclorella</i>																											
<i>Diceras</i>																											
<i>Dinobryon</i>		80	80		240	2400																					
<i>Fragilaria</i>																											
<i>Kephysion</i>	80		320		80	240	480																				
<i>Mallomonas</i>																											
<i>Neustola</i>	800	2400	400	640	720	640	560	480	320		80	80	560														
<i>Navicula</i>																											
<i>Nitzschia</i>																											
<i>Rhizosolenia</i>	320		160		80	720	400	80	80																		
<i>Stictococcus</i>	80																										
<i>Synedra</i>																											
<i>Tabellaria</i>																											
EUGLENOPHYTA																											
<i>Euglena</i>																											
<i>Trachelomonas</i>																											
CRYPTOPHYTA																											
<i>Chroomonas</i>	400	400	320	560	80	560	80	320	80		80	80	80	80	240		1040	80	240			160	720	400	400		
<i>Cryptomonas</i>	640		160	80	240												320	80	240			640	80	400	240		
<i>Rhodomonas</i>	240																										
PYRRHOPHYTA																											
<i>Glenodinium</i>																											
CYANOPROKARYOTA (Colonies counted only)																											
<i>Anabaena</i>																											
<i>Chroococcus</i>																											
<i>Mesosporea</i>																											
<i>Microcytus</i>																											
SUMMARY STATISTICS																											
DENSITY (Cells / mL):		1440	1120	400	880	560	1200	1840	880	480	1840	1840	2720	3680	1680	400	3120	800	1000	2080	1840	2080	5280	2240	880		
CHLOROPHYTA		1840	2560	1920	6000	1760	2640	4400	1040	480	480	960	1040	720	1280	1040	2000	2000	2000	320	3200	1280	3040	2240	960	9200	
CRYPTOPHYTA		0	0	80	0	0	0	0	0	80	80	0	0	0	0	0	160	160	320	80	80	0	0	0	0	0	
EUGLENOPHYTA		1280	560	400	800	160	560	80	320	160	0	0	480	80	160	560	400	880	160	80	480	0	0	640	400	400	
PYRRHOPHYTA		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CYANOPROKARYOTA		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
UNKNOWN ALGAE		80	0	0	0	640	1040	480	160	0	0	1440	720	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL		4640	4240	2960	8320	3520	4880	6480	2240	1360	3840	4080	3920	4800	3520	2000	6320	4800	1480	6560	3120	5760	8400	3600	10720		
RELATIVE ABUNDANCE:		31.0%	26.4%	13.5%	10.6%	15.9%	24.6%	28.4%	39.3%	35.3%	47.9%	45.1%	69.4%	76.7%	47.7%	20.0%	49.4%	16.7%	67.6%	31.7%	59.0%	36.1%	62.9%	62.2%	8.2%		
CHLOROPHYTA		39.7%	60.4%	64.9%	72.1%	50.0%	54.1%	67.9%	46.4%	35.3%	12.5%	23.5%	26.5%	15.0%	36.4%	52.0%	31.6%	41.7%	21.6%	48.8%	41.0%	52.8%	26.7%	26.7%	85.6%		
CRYPTOPHYTA		0.0%	0.0%	2.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	5.9%	2.1%	0.0%	0.0%	0.0%	0.0%	8.0%	2.5%	6.7%	5.4%	1.2%	0.0%	0.0%	1.0%	0.0%	0.0%	
EUGLENOPHYTA		27.6%	13.2%	13.6%	9.6%	4.5%	11.5%	0.2%	14.3%	11.8%	0.0%	11.8%	2.0%	3.3%	15.9%	20.1%	13.9%	33.3%	5.4%	7.3%	0.0%	11.1%	9.5%	1.1%	1.1%	6.0%	
PYRRHOPHYTA		0.0%	0.0%	5.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
CYANOPROKARYOTA		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
UNKNOWN ALGAE		1.7%	0.0%	0.0%	7.7%	29.5%	9.8%	2.5%	0.0%	0.0%	37.5%	17.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
TOTAL		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%		
TAXONOMIC RICHNESS:		4	2	1	4	2	5	4	4	2	4	3	6	5	3	4	4	4	4	7	4	4	6	3	2		
CHLOROPHYLL a (ug/L):		TOTAL	4.1	5.1	9.6	6.7	5.3	4.5	5.5	4.4	5	6.7	12.3	7.3	2.1	14	4.6										

NOTE: EUDORINA BLOOM AT INTAKE TOWER ON 05/12/04. SEE FORM FOR DETAILS.

NOTE: ANABAENA AND MICROCYSTIC BLOOM ON 10/26/04

